OHDSI

State of the Community: Where have we been? Where are we going?

George Hripcsak MD MS

Director, Columbia University OHDSI Coordinating Center
Professor of Biomedical Informatics
Columbia University Irving Medical Center

Welcome to OHDSI 2023!

Thank you OHDSI 2023 Symposium Sponsors!

Thank you for OHDSI 2023 Scientific Review Committee

- Adrien Coulet
- Amanda Robison-Chadwell
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- Hanieh Razzaghi
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- Melanie Philofsky
- Mui Van Zandt
- Nsikak Akpakpan
- Patrick Ryan
- Paul Nagy
- Rohit Vashisht
- Rupa Makadia
- Sarah Seager
- Seng Chan You
- Thamir Alshammari
- Tiffany Callahan
- Tina Parciak

Please stand!

Thank you to those who made today happen

- Elisse Katzman
- Craig Sachson
- Jody-Ann McLeggon
- Ann Marshak
- Anita Barrett
- Sofia Ellis-Chin
- Randi Kaplan
- Patrick Ryan

- Tara Anand
- Kanchan Chaudhari
- Cindy Chen
- Pooja Desai
- Abby Newbury
- Elise Ruan
- Harry Reyes
- OHDSI Steering Workgroup

Please stand!

Our Journey

Where The OHDSI Community Has Been

And Where We Are Going

2023 edition

OHDSI
OBSERVATIONAL HEALTH DATA SCIENCES AND INFORMATICS

Thank you Craig Sachson

**Soon to be Happy 10th Birthday OHDSI
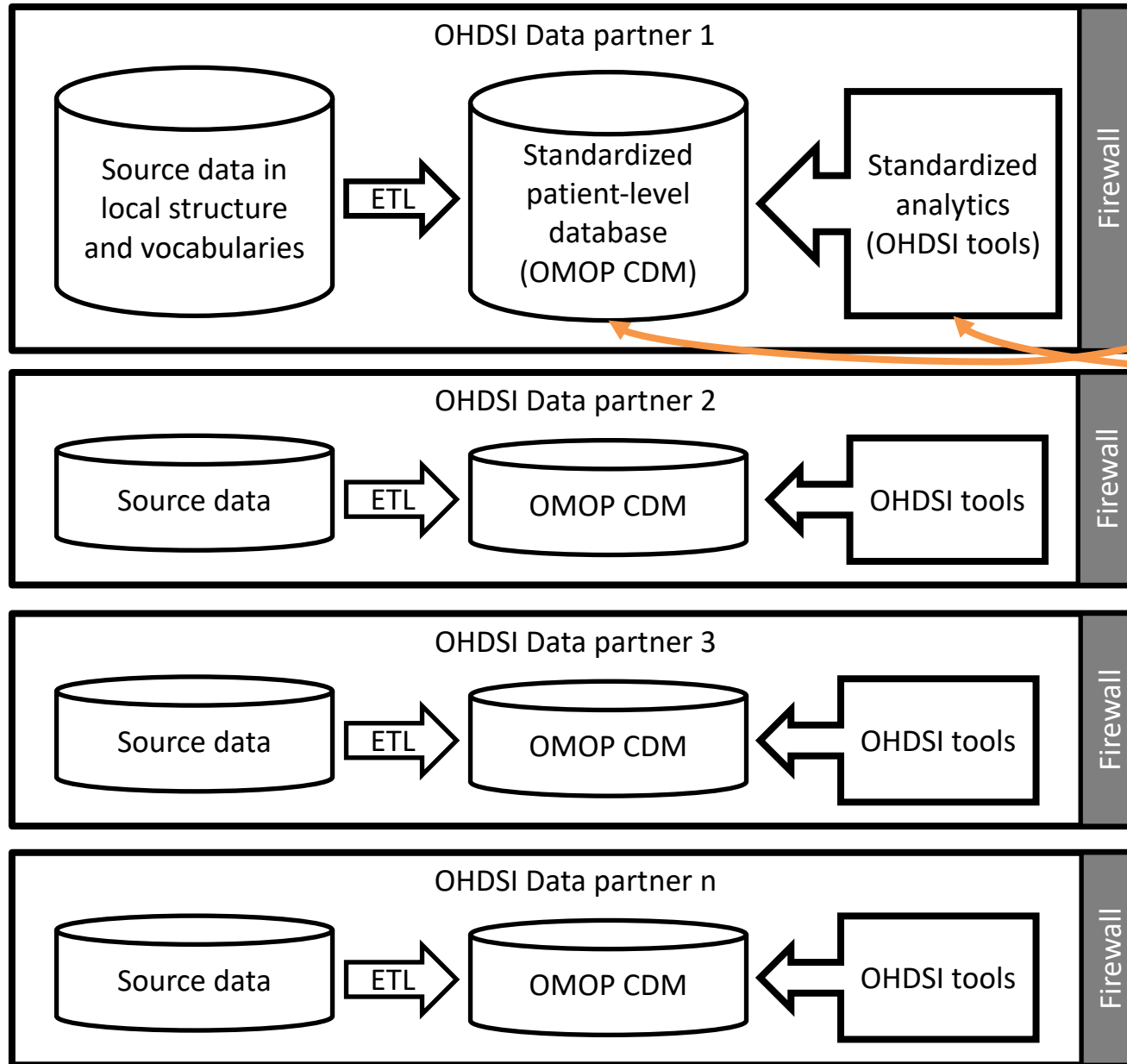November 6 or December 16, 2013**

OHDSI's mission

To improve health by empowering a community to collaboratively generate the evidence that promotes better health decisions and better care
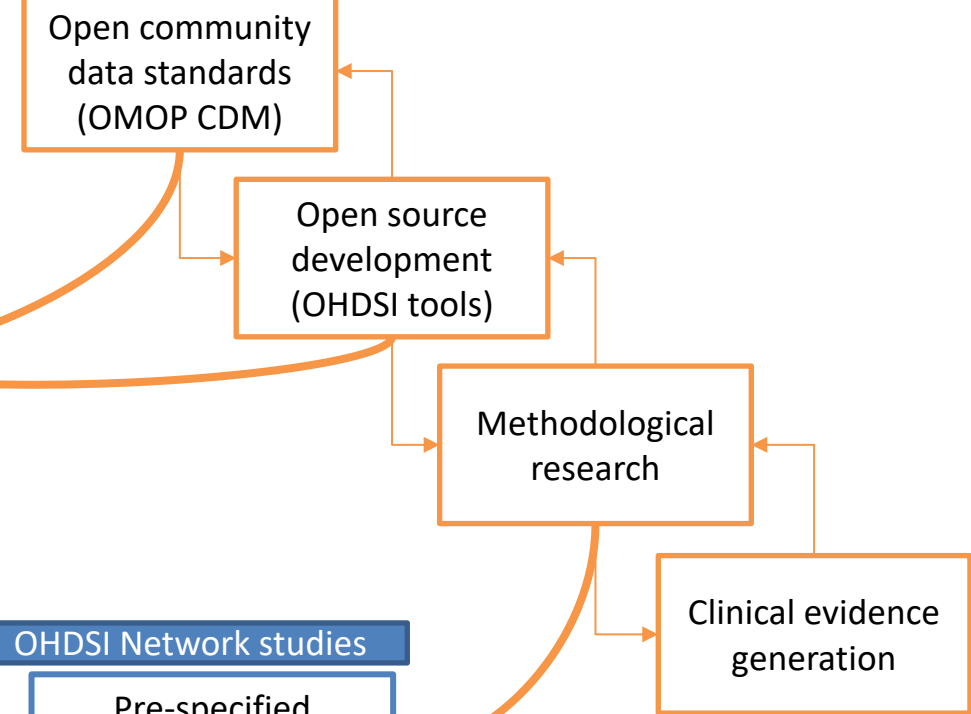
OHDSI's values

- **Innovation**: Observational research is a field which will benefit greatly from disruptive thinking. We actively seek and encourage fresh methodological approaches in our work.
- **Reproducibility**: Accurate, reproducible, and well-calibrated evidence is necessary for health improvement.
- **Community**: Everyone is welcome to actively participate in OHDSI, whether you are a patient, a health professional, a researcher, or someone who simply believes in our cause.
- **Collaboration**: We work collectively to prioritize and address the real world needs of our community's participants.
- **Openness**: We strive to make all our community's proceeds open and publicly accessible, including the methods, tools and the evidence that we generate.
- **Beneficence**: We seek to protect the rights of individuals and organizations within our community at all times.
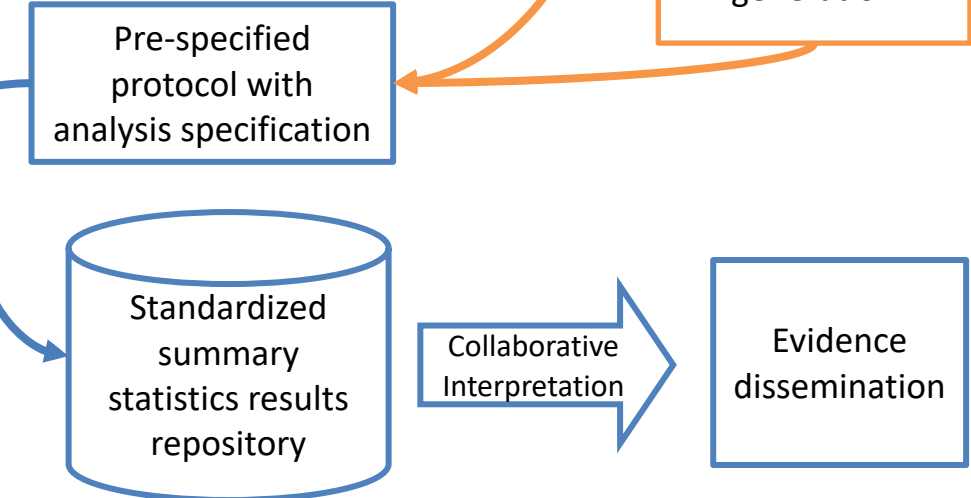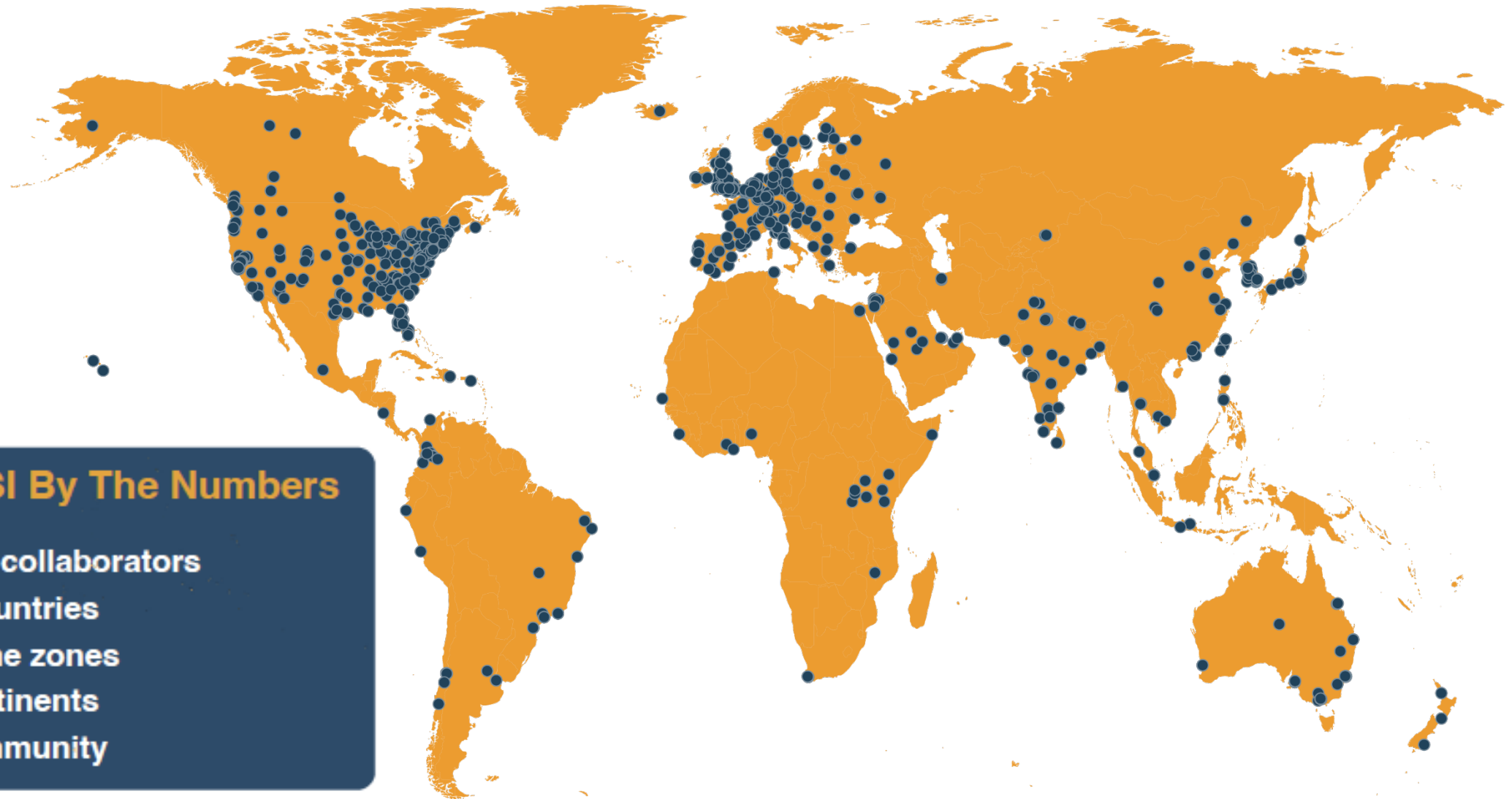
Map of collaborators

OHDSI By The Numbers

- 3,758 collaborators
- 83 countries
- 21 time zones
- 6 continents
- 1 community

Regional Chapters and National Nodes

An OHDSI regional chapter represents a group of OHDSI collaborators located in a geographic area who wish to hold local networking events and meetings to address problems specific to their geographic location.

The OHDSI Europe Chapter, in collaboration with the EHDEN project, recently created National Nodes to facilitate national and international collaborations.

An OHDSI Europe National Node is a collection of research institutes within a member country. The Node builds on the strengths of the stakeholders and scientific communities of that country.

Each Node has a lead institute that oversees the work of that Node and assigns a lead and co-lead.

Regional Chapters

Africa
Leads: Ahmed El Sayed, Cynthia Sung

Australia
Lead: Nicole Pratt

China
Lead: Hua Xu

Europe
Lead: Peter Rijnbeek

India
Lead: Lakshmi Kubendran

Japan
Lead: Tatsuo Hiramatsu

Republic of Korea
Lead: Seng Chan You

Singapore
Lead: Mengling 'Mornin' Feng

Taiwan
Lead: Jason Hsu

European National Nodes

Belgium
Lead Institutions: Hasselt University, University Hospital Antwerp

Germany
Lead Institution: Technische Universität Dresden

Greece
Lead Institution: The Institute of Applied Biosciences, Centre for Research and Technology Hellas

Italy
Lead Institution: University of Pavia

Luxembourg
Lead Institutions: Luxembourg Institute of Health, Information Technology for Translational Medicine S.A.

The Netherlands
Lead Institution: Erasmus MC University Medical Center

Portugal
Lead Institution: Centro Hospitalar E Universitario De Coimbra Epe

Spain
Lead Institutions: Consorci Parc de Salut Mar Barcelona, IDIAPJGol

United Kingdon
Lead Institution: Health Data Sciences Section, Botnar Research Centre, University of Oxford

Thank you, EHDEN for the success in building an OHDSI community across Europe

OHDSI Workgroups

OHDSI has a central mission to improve health globally, but there are countless areas where our community can be of service. Work around data, methods, open-source tools, and clinical applications are all pieces of the puzzle, and within OHDSI, there are opportunities to work in any or many of these areas.

Our workgroups, led by the extraordinary leads shown on these pages, present opportunities for all community members to find a home for their talents and passions, and make meaningful contributions. We are always looking for new collaborators. See an area where you want to contribute? Please Join The Journey!

www.ohdsi.org/workgroups

APAC
Mui Van Zandt

ATLAS/WebAPI
Christopher Knoll
Alexey Manoylenko
Anthony Sena

Clinical Trials
Mike Hamidi
Tom Walpole

Clinical Trials
Lin Zhen

Common Data Model
Clair Blacketer

Dentistry
Robert Koski

Early-Stage Researchers
Faaizah Arshad
Ross Williams

Education
Kristin Kostka

Eye Care & Vision Research
Sally Baxter
Kerry Goetz
Michelle Hribar

FHIR and OMOP
Davera Gabriel
Christian Reich
Gus Tsafnat

GIS - Geographic Information System
Robert Miller
Andrew Williams
Kyle Zollo-Venecek
Martijn Schuemie

HADES
Atif Amin

Health Equity
Jake Gillberg

Healthcare Systems
Melanie Philofsky

Latin America
Jose Posada

Medical Devices
Asiyah Lin

Medical Imaging
Paul Nagy
Seng Chan You

Methods Research
Martijn Schuemie

Methods Research
Marc Suchard

Natural Language Processing
Vipina Keloth
Hua Xu

Network Data Quality
Clair Blacketer

Oncology
Asieh Golozar

Open-Source Comm.
Adam Black

Open-Source Comm.
Paul Nagy

Patient-Level Prediction
Jenna Reps
Ross Williams

Perinatal and Reproductive Health
Alison Callahan
Stephanie Leonard
Louisa Smith

Phenotype Development & Evaluation
Gowtham Rao
Azza Shoaibi

Psychiatry
Dmitry Dymshyts
Andrew Williams

Registry
Tina Parciak

Steering Group
George Hripcsak

Steering Group
Patrick Ryan

Surgery and Perioperative Medicine
Jenny Lane
Evan Minty

Vaccine Vocabulary
Oliver He
Asiyah Lin

OHDSI Workgroups Homepage

Join an OHDSI Workgroup

OMOP Common Data Model 5.4
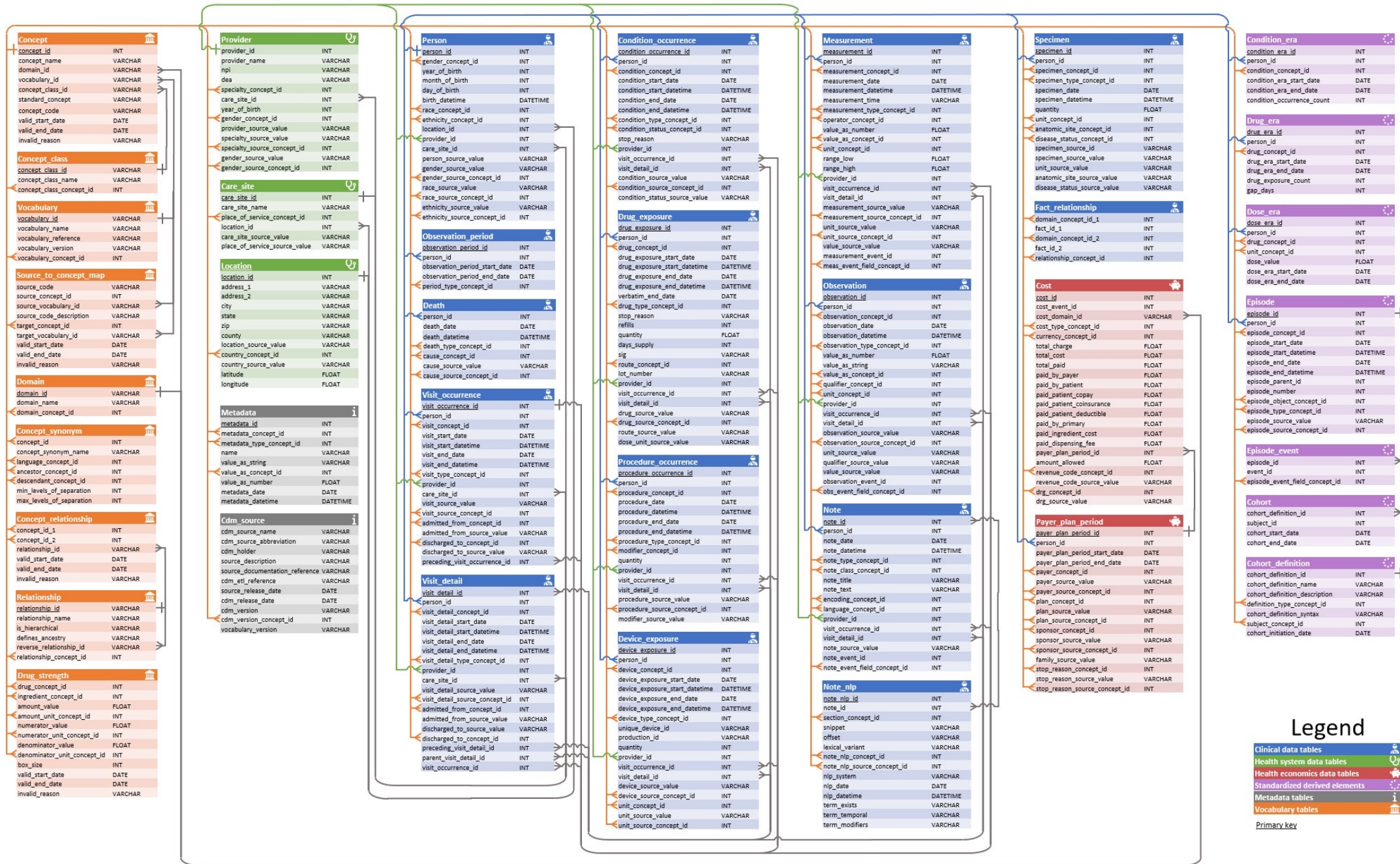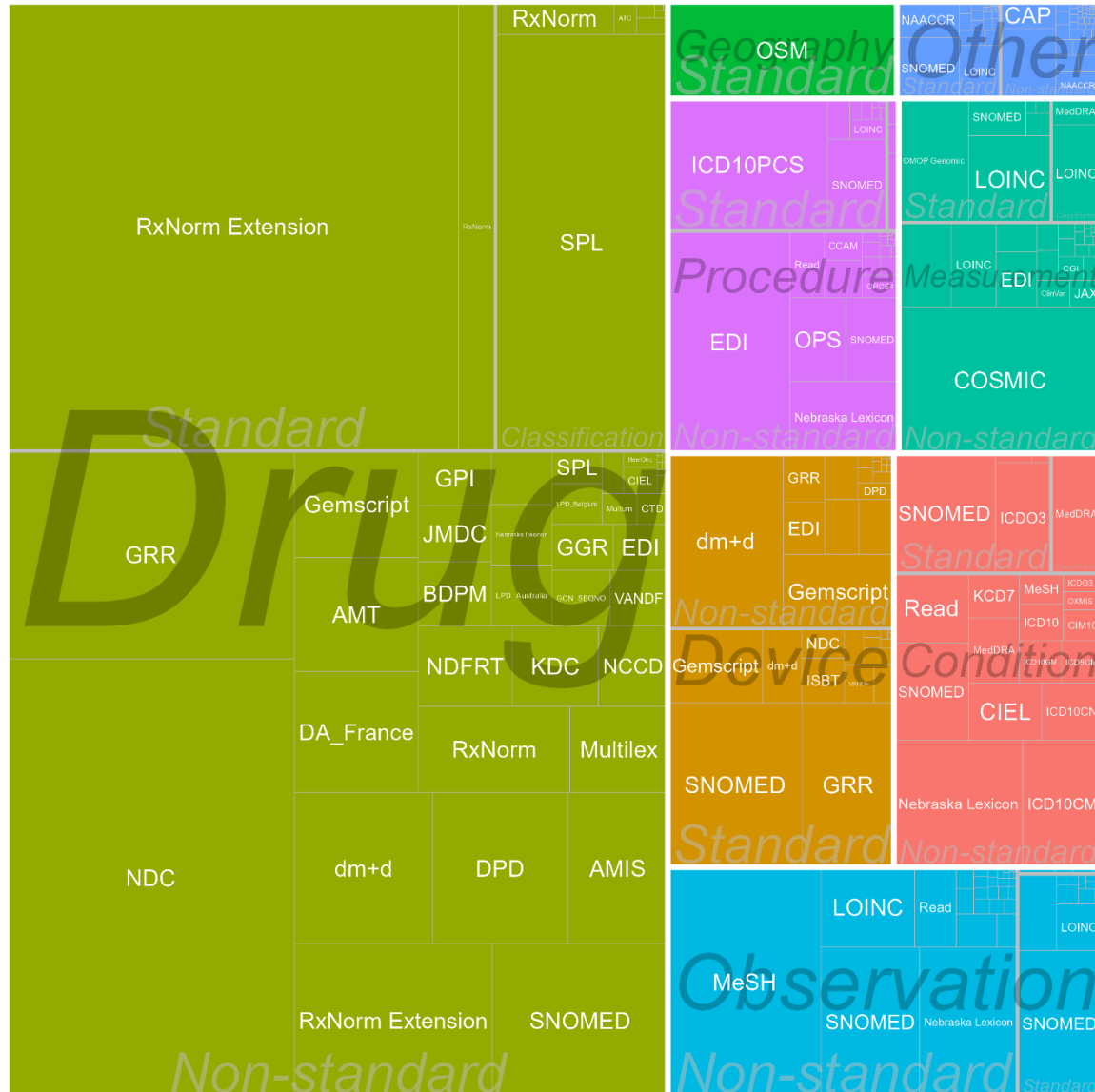
OHDSI standardized vocabularies
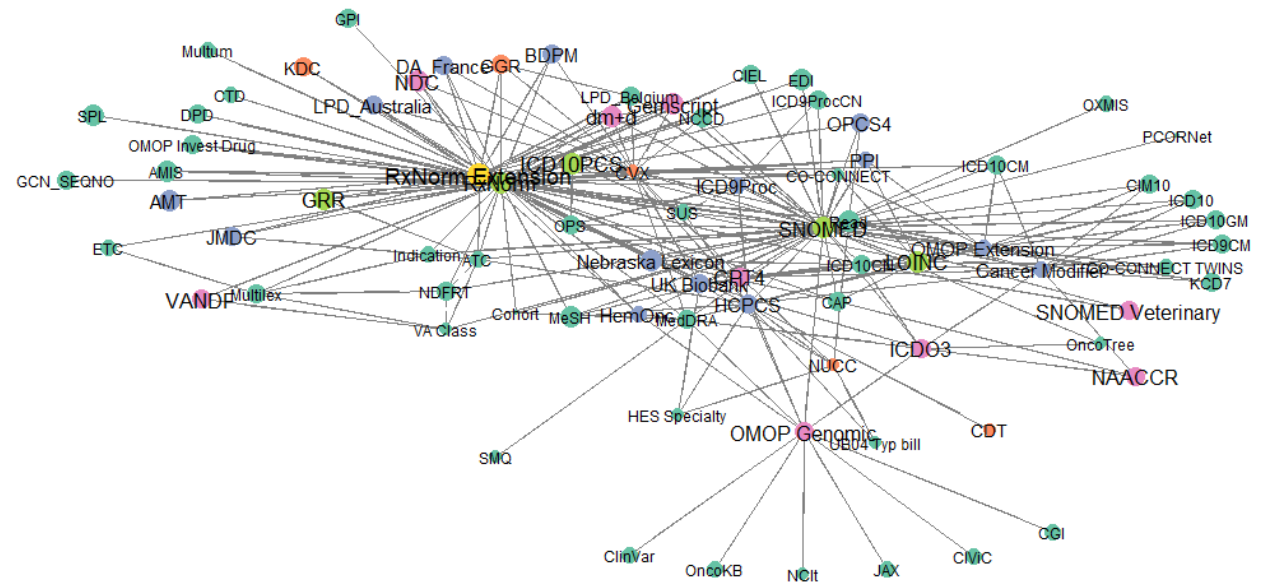
OHDSI Vocabularies Improvement Initiative

Will hear more about this in Alexander's talk

Landscape assessment

FINDINGS

- 87% of the community feels confident about Vocabularies' integrity

- Most commonly used vocabularies: SNOMED, ICD 9/10 (US and int versions), MedDRA, ICDO3, ATC, RxNorm/RxE, ICD10PCS, ICD9Proc, CPT4, LOINC, CVX, HCPCS, UCUM, NDC, NAACCR, Cancer Modifier

- Most update data annually or semi-annually

NEEDS

- Transparent release schedule

- Vocabulary changes, versioning

- Transparent QA/QC

- Better coverage and hierarchies

- More documentation and educational materials

Vocabulary committee

Patrick Ryan · George Hripcsak · Peter Rijnbeek
Rae Woong Park · Mui Van Zandt · Christian Reich

Vocabulary team

Alexander Davydov · Timur Vakhitov · Oleg Zhuk · Vlad Korsik
Maria Rogozhkina · Varvara Savitskaya · Mikita Salavei · Irina Zherka · Masha Khitrun
Tetiana Orlova · Tanya Skugarevskaya · Dmitry Buralkin · Janice Cruz · Anna Ostropolets

Release schedule and roadmap

Community contributions

Quality framework & documentation

OMOP Common Data Model adoption
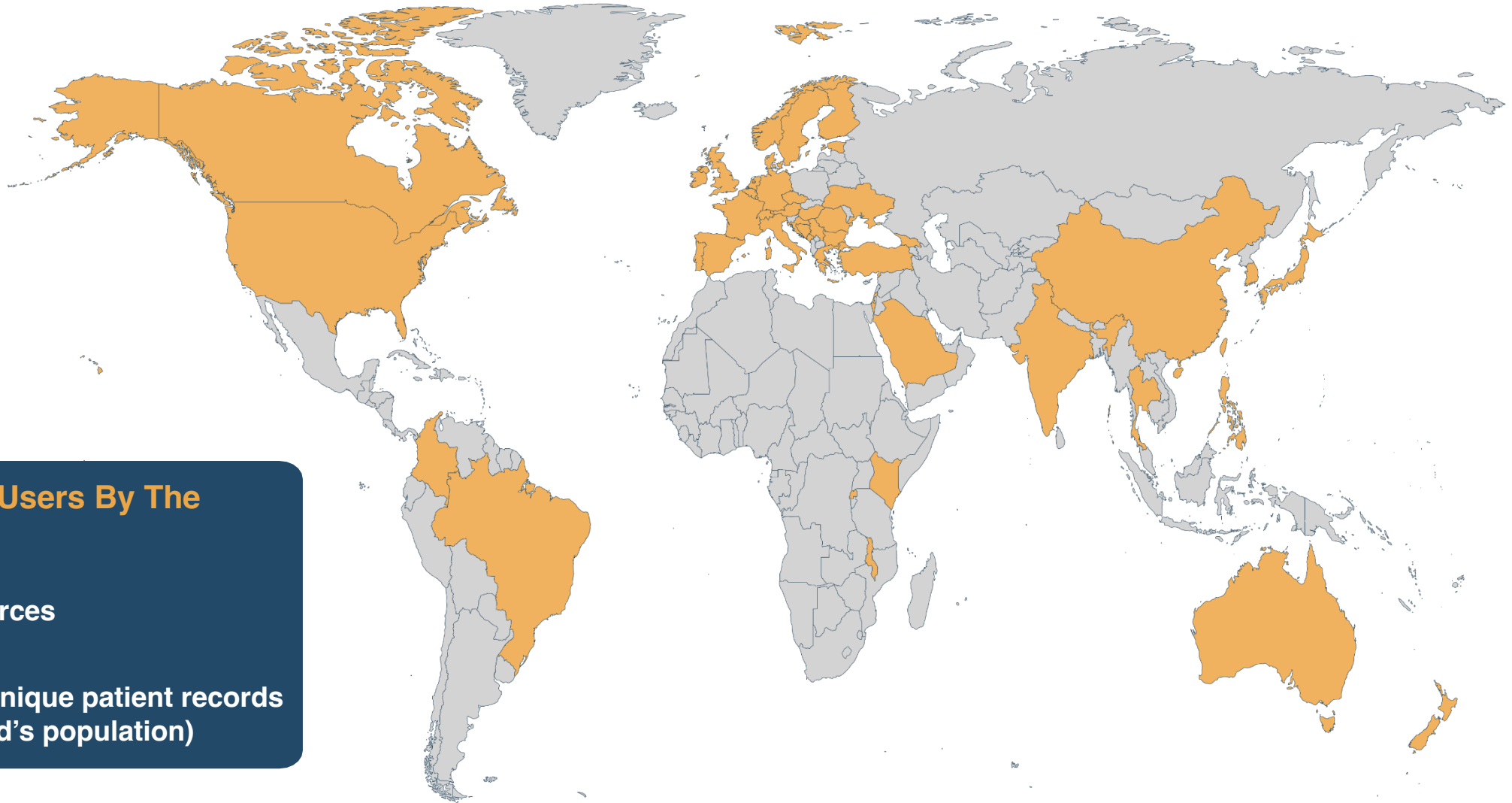
OMOP CDM Users By The Numbers

- 534 data sources
- 49 countries
- 956 million unique patient records (12% of world's population)

OHDSI Evidence Network

OHDSI is proud to have a global community dedicated to generating real-world evidence and which recognizes the opportunity to collaborate together as part of a distributed network based on standardized data and standardized analytics.

The OHDSI Evidence Network consists of organizations equipped with access to one or more databases standardized to the OMOP CDM who express a keen interest in participating in OHDSI network studies. Collaboratively, OHDSI Evidence Network partners share aggregate summary statistics about their databases, which are used to support Database Diagnostics, helping identify databases within the network that are fit-for-use for particular research questions. Additionally, partners have the opportunity to opt in and contribute to network studies proposed by the OHDSI community.

The recent SOS challenge serves as a compelling demonstration of the OHDSI Evidence Network's current capabilities and its promising future potential. We wholeheartedly encourage all organizations that are adopting the OMOP CDM and aspire to apply standardized analytics for the reliable generation of real-world evidence to become part of the OHDSI Evidence Network.

A message from Common Data Model workgroup lead Clair Blacketer …

During the first community call of 2023, Patrick Ryan unveiled the strategic priorities for the OHDSI Community for the year. Among these, a key focus is on enhancing the transparency and maturity of the OHDSI network.

To address this objective, we began by considering how network studies are currently conducted, recognizing the challenges and complexities faced by collaborating organizations when contributing to the body of evidence. This investigation led to the creation of Database Diagnostics, a tool designed to answer a critical question: when tackling a specific research inquiry, which data sources within the OHDSI Evidence Network are the most relevant and suitable for generating robust evidence?

This innovative approach leverages aggregated summary statistics from each data source, obtained through the open-source tool dbProfile. It evaluates data fitness-for-use across various dimensions, including patient demographics, domain coverage of target, comparator, and out to establish these database pr Evidence Network.

Pillar #2: Standardized data network

- Opportunity: Increase transparency and maturity of OHDSI data network
- Proposed solutions:
  - Create OHDSI data network catalog to encourage network studies across interested partners and promote data quality practices
  - Generate OHDSI network concept prevalence data and make accessible for ATLAS users to enable more generalizable phenotype development
  - Promote database diagnostics by having data partners share limited subset of ACHILLES to allow for users to identify databases that satisfy study criteria

Will hear more about this in Clair's talk

Organizations and Data Sources in the OHDSI Evidence Network

Ajou University • Ajou University
Casa di Cura Igea • Casa di Cura Igea
Clinical Center of Montenegro • Clinical Center of Montenegro
Columbia University Medical Center • Columbia University Medical Center
Hong Kong University • UK THIN
IQVIA • Australia EMR
IQVIA • Disease Analyzer France
IQVIA • Disease Analyzer Germany
IQVIA • Japan Claims
IQVIA • Japan HIS
IQVIA • Longitudinal Patient Database (LPD) in Belgium
IQVIA • Longitudinal Patient Database (LPD) in France
IQVIA • Longitudinal Patient Database (LPD) in Italy
IQVIA • Longitudinal Patient Database (LPD) in Spain
IQVIA • OMOP US Hospital Data Master
IQVIA • Pharmetrics Plus
IQVIA • UK Medical Research Data EMIS
IQVIA • UK Medical Research Data THIN
IQVIA • US Open Claims
Janssen Research & Development • JMDC
Janssen Research & Development • Merative® Marketscan® Commercial Claims and Encounters
Janssen Research & Development • Merative® Marketscan® Medicare Supplemental

Janssen Research & Development • Merative® Marketscan® Multi-State Medicaid
Janssen Research & Development • Optum's Clinformatics® Data Mart - Date of Death
Janssen Research & Development • Optum's Clinformatics® Data Mart - Socio-Economic Status
Janssen Research & Development • Optum's Longitudinal EHR Repository
Janssen Research & Development • Premier Healthcare Database
Johns Hopkins University • Johns Hopkins University
National University of Singapore • National University of Singapore
Northeastern • IQVIA Pharmetrics Plus
Organization Name • Data Source Name
Taipei Medical University • Taipei Medical University
Tufts University Medical Center • Tufts University Medical Center
University of Nebraska Medical Center • University of Nebraska Medical Center
University of Southern California • Keck Medical Center
US Department of Veteran's Affairs • US Department of Veteran's Affairs
Yinzhou Bigdata Platform • Yinzhou Bigdata Platform

On March 28, 2023, the OHDSI Global Community initiated the Save Our Sisyphus (SOS) Challenge, a groundbreaking opportunity for collaborative research involving simultaneous participation in four different network studies. What made it truly remarkable was that any organization interested in joining the OHDSI Evidence Network could contribute to these studies by sharing their database profiles for the data sources they had access to. These profiles were centrally aggregated at the OHDSI Central Coordinating Center, enabling us to empirically determine which of the four study questions each data source was best suited to address. This inaugural OHDSI Evidence Network endeavor encompassed 36 diverse adata sources from 16 different organizations. Not only did this foster rapid evidence generation and collaboration during the SOS Challenge, but it also positioned us for future collaborations on additional network studies as part of the OHDSI Evidence Network.

If you are interested in becoming a part of the OHDSI Evidence Network and contributing to advancing evidence-based healthcare, please use the provided QR code to complete a brief form about your organization and your data source. A member of the OHDSI Network Data Quality Working Group will reach out to you to explore this exciting opportunity further!

Join The OHDSI Evidence Network

Will hear more about this in Katy's talk

HADES

HADES is a set of open source R packages for large scale analytics, including population characterization, population-level causal effect estimation, and patient-level prediction.

The packages offer R functions that together can be used to perform an observational study through the full journey from data to evidence, including data manipulation, statistical modeling, and results generation with supporting statistics, tables and figures.

Each package includes functions for specifying and subsequently executing multiple analyses efficiently. HADES supports best practices for use of observational data as learned from previous and ongoing research, such as transparency, reproducibility, as well as measuring of the operating characteristics of methods in a particular context and subsequent empirical calibration of estimates produced by the methods.

Learn more about the individual HADES packages in this section.
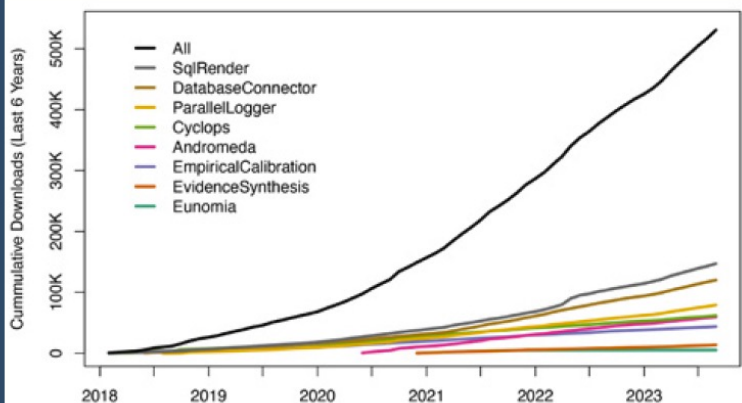
The eight HADES packages shown above have been released on CRAN and have been downloaded more than 500,000 times.

HADES Maintainers

The open-source tools that empower OHDSI research are not only available to the community, but they are DEVELOPED by the community. We thank the many developers and maintainers who empower our research initiatives around the world!

Adam Black
Frank DeFalco
Lee Evans
Egill Fridgeirsson
Jamie Gilbert
Christopher Knoll
Martin Lavallee
Gowtham Rao
Jenna Reps
Peter Rijnbeek
Katy Sadowski
Martijn Schuemie
Anthony Sena
Marc Suchard
Joel Swerdel

Package	Version	Maintainer(s)	Availability
Achilles	v1.7.2	Frank DeFalco	CRAN
Andromeda	v0.6.3	Adam Black	CRAN
BigKnn	v1.0.2	Martijn Schuemie	GitHub
BrokenAdaptiveRidge	v1.0.0	Marc Suchard	CRAN
Capr	v2.0.7	Martin Lavallee	GitHub
Characterization	v0.1.2	Jenna Reps	GitHub
CirceR	v1.3.1	Chris Knoll	GitHub
CohortDiagnostics	v3.2.4	Jamie Gilbert	GitHub
CohortExplorer	v0.0.17	Gowtham Rao	CRAN
CohortGenerator	v0.8.0	Anthony Sena	GitHub
CohortMethod	v5.1.0	Martijn Schuemie	GitHub
Cyclops	v3.3.1	Marc Suchard	CRAN
DatabaseConnector	v6.2.4	Martijn Schuemie	CRAN
DataQualityDashboard	v2.4.0	Katy Sadowksi	GitHub
DeepPatientLevelPrediction	v2.0.0	Egill Fridgeirsson	GitHub
EmpiricalCalibration	v3.1.1	Martijn Schuemie	CRAN
EnsemblePatientLevelPrediction	v1.0.2	Jenna Reps	GitHub
Eunomia	v1.0.2	Frank DeFalco	GitHub
EvidenceSynthesis	v0.5.0	Martijn Schuemie	CRAN
FeatureExtraction	v3.3.1	Anthony Sena	GitHub
Hydra	v0.4.0	Anthony Sena	GitHub
IterativeHardThresholding	v1.0.2	Marc Suchard	CRAN
MethodEvaluation	v2.3.0	Martijn Schuemie	GitHub
OhdsiSharing	v0.2.2	Lee Evans	GitHub
OhdsiShinyModules	v2.0.0	Jenna Reps	GitHub
ParallelLogger	v3.3.0	Martijn Schuemie	CRAN
PatientLevelPrediction	v6.3.5	Jenna Reps & Peter Rijnbeek	GitHub
PhenotypeLibrary	v3.25.0	Gowtham Rao	GitHub
PheValuator	v2.2.10	Joel Swerdel	GitHub
ResultModelManager	v0.5.1	Jamie Gilbert	GitHub
ROhdsiWebApi	v1.3.3	Gowtham Rao	GitHub
SelfControlledCaseSeries	v4.2.0	Martijn Schuemie	GitHub
SelfControlledCohort	v1.6.0	Jamie Gilbert	GitHub
ShinyAppBuilder	v1.1.2	Jenna Reps	GitHub
SqlRender	v1.16.1	Martijn Schuemie	CRAN

OHDSI scholarship
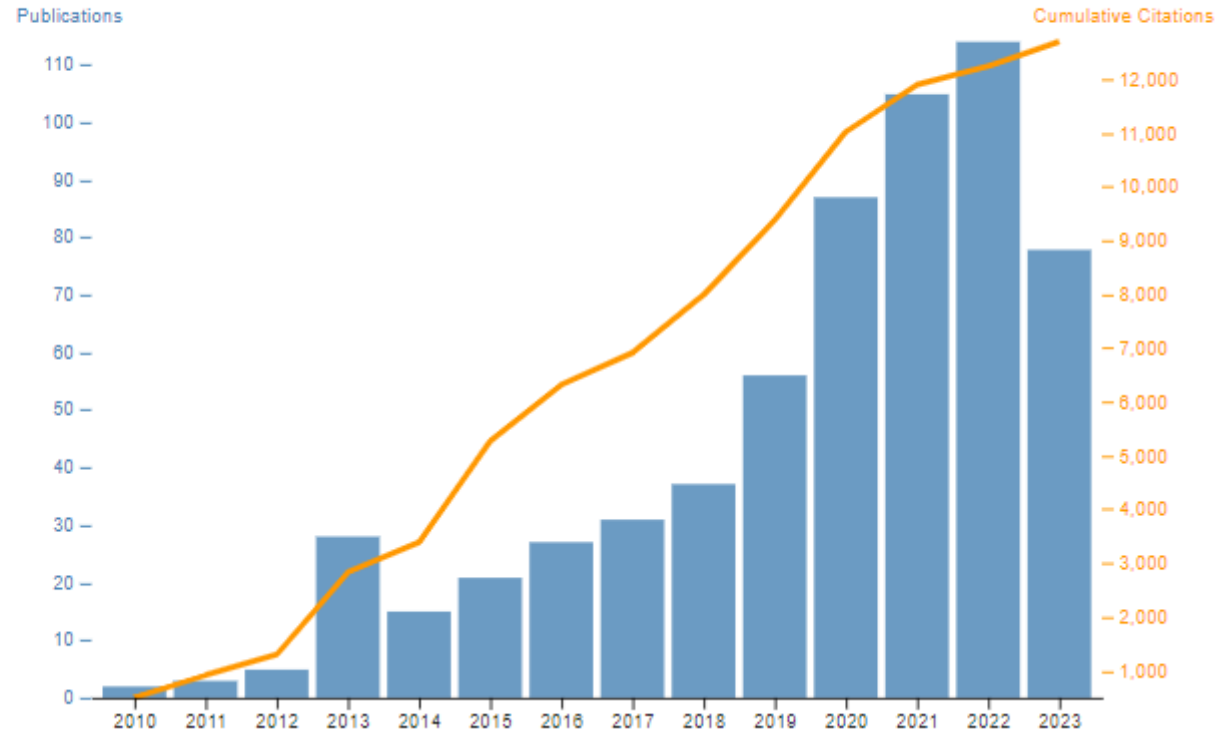

Publications & Cumulative Citations

Summary

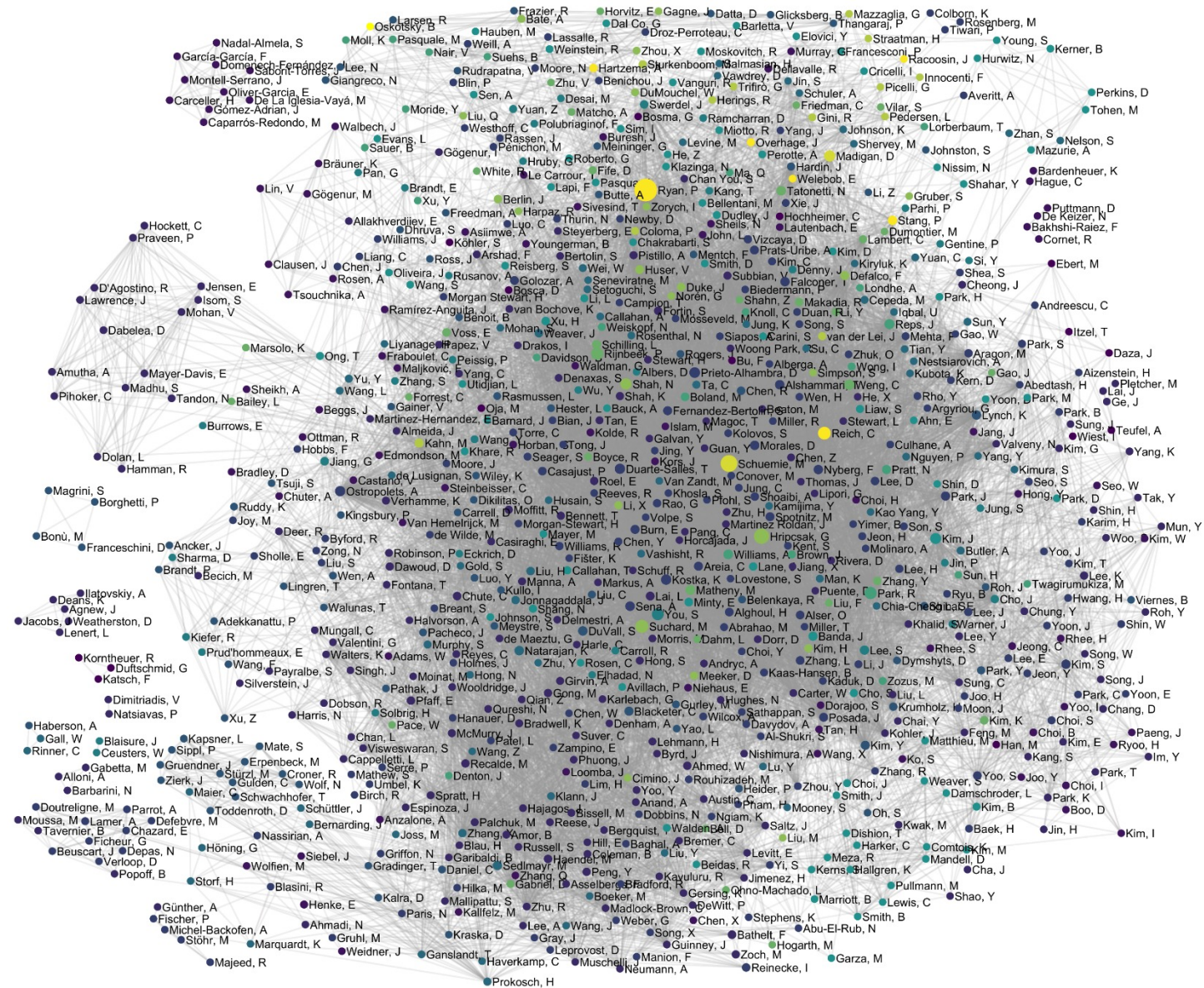**609** PubMed Manuscripts

3613 PubMed Authors

OHDSI collaborations in scholarship

Save Our Sisyphus Challenge

OHDSI's central mission is to generate real-world evidence that positively impacts global health. Achieving that mission requires rigorous network studies and an open-science asystem that can build trust in the evidence generated through these collaborative studies.

The OHDSI community works hard to build both methodological best practices for network studies and the open-source tools to carry them forward, but that doesn't mean the process is simple. In fact, it's so challenging that it requires a team effort.

During the spring of 2023, the OHDSI community initiated the SOS Challenge, a global effort to design, implement, execute and ultimately disseminate four network studies. Two studies were featured weekly over the course of nine community calls in different time zones to be inclusive for all collaborators, while two other studies were run asynchronously. While doing this, OHDSI faculty provided focused sessions to teach each step of the network study journey. The SOS Challenge homepage has each tutorial video, as well as information on all four studies.

www.ohdsi.org/SOS-Challenge

Studies & Their Leads

Will hear more about this in later panel with Cindy, Chan, Anthony, and Marc

Cindy Cai
Zenas Yiu
Jack Janetzki
Jung Ho Kim
Nicole Pratt
Seng Chan You
Thamir Alshammari

The Process

Engineering open science systems that build trust into the real-world evidence generation and dissemination process

System characteristics:
- Standardized procedures with defined inputs and outputs
- Analysis packages implementing scientific best practices consistently applied across all data partners, generating consistent output for network synthesis
- Reproducible outputs generated by open-source analysis libraries developed and validated with verifiable unit-test coverage
- Pre-specified and objective decision thresholds for go/no go criteria
- Measurable operating characteristics of system performance

Weekly Tutorials

1. ....Initiating A Network Study
.......................stics
.......................ment
.......................ation
.......................ions
.......................ution
7. ....Study Diagnostics
8. .... Evidence Synthesis
9. ....Interpreting The Results

Learn More

Want to learn more about any of these steps? Check out the homepage, which has all tutorial videos!

The People
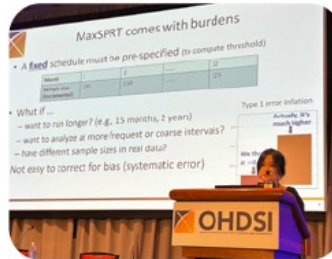
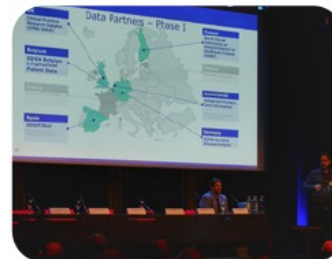# OHDSI Symposia

Oct. 14-16, 2022 • Bethesda, Md.

Nov. 12-13, 2022 • Taipei, Taiwan

July 1-3, 2023 • Rotterdam, Neth.

July 13-14, 2023 • Sydney, Australia

Will hear more about this in Peter's and Mornin's talks

MASTERS OF SCIENCE
BOUVÉ COLLEGE OF HEALTH SCIENCES

Real World Evidence in Healthcare and Life Sciences

Northeastern University
Observational Health Data Sciences and Informatics Center

Core Requirements	Selective
Introduction to Real World Evidence	Phenotyping
Foundations of Data Models	Cohort Building
Methods for Observational Research 1	Advanced Population Characterization
Standardization of Real World Data	Advanced Population Estimation
Data Model Transformation	Advanced Patient Prediction
Methods for Observational Research 2	
Research Skills and Ethics	
Capstone	

How do you get involved?

Community calls every Tuesday:

Upcoming Community Calls

Date	Topic
Oct. 17	Symposium Week! Final Logistics + Mad Minutes
Oct. 24	Welcome to OHDSI
Oct. 31	TBA
Nov. 7	Meet The Titans
Nov. 14	Collaborator Showcase Honorees
Nov. 21	Showcase Software Demos

@OHDSI   www.ohdsi.org   #JoinTheJourney   in ohdsi

How Can You Join The Journey?

Our community has set both the foundation and the highest of standards for global collaboration around observational research. We continue to make real differences in healthcare, and we are doing it through transparent and reproducible science. We also recognize that there is so much more to be done, and so much more that we can do.

If you are inspired by what you read in this book, if you want to learn more about methods research or open-source development, if you have a clinical question you believe needs answering, or if you want to join a community of people dedicated to the team sport of observational health data sciences and informatics, we have a place for you.

How can you get started?

Step One: Join The OHDSI Forums (forums.ohdsi.org)
Connect with other OHDSI collaborators on our community forums and start discussing how you can help us inform medical decision-making, or simply follow discussions that are interesting to you and learn about the work happening within our global community.

Step Two: Join Our Workgroups & MS Teams Environment (ohdsi.org/ohdsi-workgroups)
OHDSI has 27 active workgroups that always seek new collaborators. Our workgroups present opportunities for all community members to find a home for their talents and passions, and a place to make meaningful contributions. Our workgroups collaborate inside the OHDSI MS Teams environment; a form to join our Teams environment is available here: bit.ly/Join-OHDSI-Teams.

Step Three: Join Our Community Calls (ohdsi.org/community-calls/)
Join collaborators around the world each week during our OHDSI Community Call, held Tuesdays at 11 am ET within our Teams environment. Following weekly updates, we have a variety of call formats, including research presentations, workgroup updates, discussions, debates and more. These calls are recorded, and you can access them (as well as the meeting link) at our Community Calls page.

Step Four: Continue To Learn About OHDSI
Learn about OHDSI tools and research processes in a variety of ways.

· The Book of OHDSI (which is also translated into both Korean and Chinese) is a community-developed resource with information for every step of your journey: ohdsi.github.io/TheBookOfOhdsi

· Check out the EHDEN Academy, a set of free, on-demand training and development courses. These are open to anybody, but we always encourage new OHDSI collaborators to use this resource to learn about best practices towards our mission of improving health by empowering a community to collaboratively generate evidence that promotes better health decisions and better care: academy.ehden.eu

· Our OHDSI News page keeps you informed of recent news, publications, upcoming studies and more, while also profiling collaborators and providing other updates: ohdsi.org/ohdsi-news-updates

· Check out the OHDSI YouTube page (youtube.com/c/OHDSI) for many community-developed learning resources, including tutorials, research presentations and more. Follow OHDSI on both Twitter (@OHDSI) and LinkedIn (OHDSI) to keep updated on community research and follow the #OHDSISocialShowcase to see the research shared at our annual symposia.

Join The Journey
Your journey with OHDSI has started. Your interest in our global community is the first step in making a difference in global health. There is no limit to the impact you can make, and you can do so in a supportive, positive and fun environment. We invite you to search our website, post to the forum, join us in Teams, check out our GitHub (github.com/OHDSI), or reach out to us over email (contact@ohdsi.org).

Thank you for Joining The Journey with OHDSI!

Engineering open science systems that build trust into the real-world evidence generation and dissemination process

'System' required elements:
- Required phenotypes
- Analysis specifications
- Decision thresholds

Distributed data network, standardized to common data model

Network coordination

Data quality evaluation
- Research question → Database diagnostics
  - Pass
  - Fail → STOP

Phenotype development and evaluation
- Cohort definitions → Cohort diagnostics
  - Pass
  - Fail → STOP

Analysis reliability evaluation
- Analysis design choices → Study diagnostics
  - Pass
  - Fail → STOP

Final unblinded results

Interface for exploration

System characteristics:
- Standardized procedures with defined inputs and outputs
- Analysis packages implementing scientific best practices consistently applied across all data partners, generating consistent output for network synthesis
- Reproducible outputs generated by open-source analysis libraries developed and validated with verifiable unit-test coverage
- Pre-specified and objective decision thresholds for go/no go criteria
- Measurable operating characteristics of system performance

Large-scale Evidence Generation and Evaluation across a Network of Databases (LEGEND)
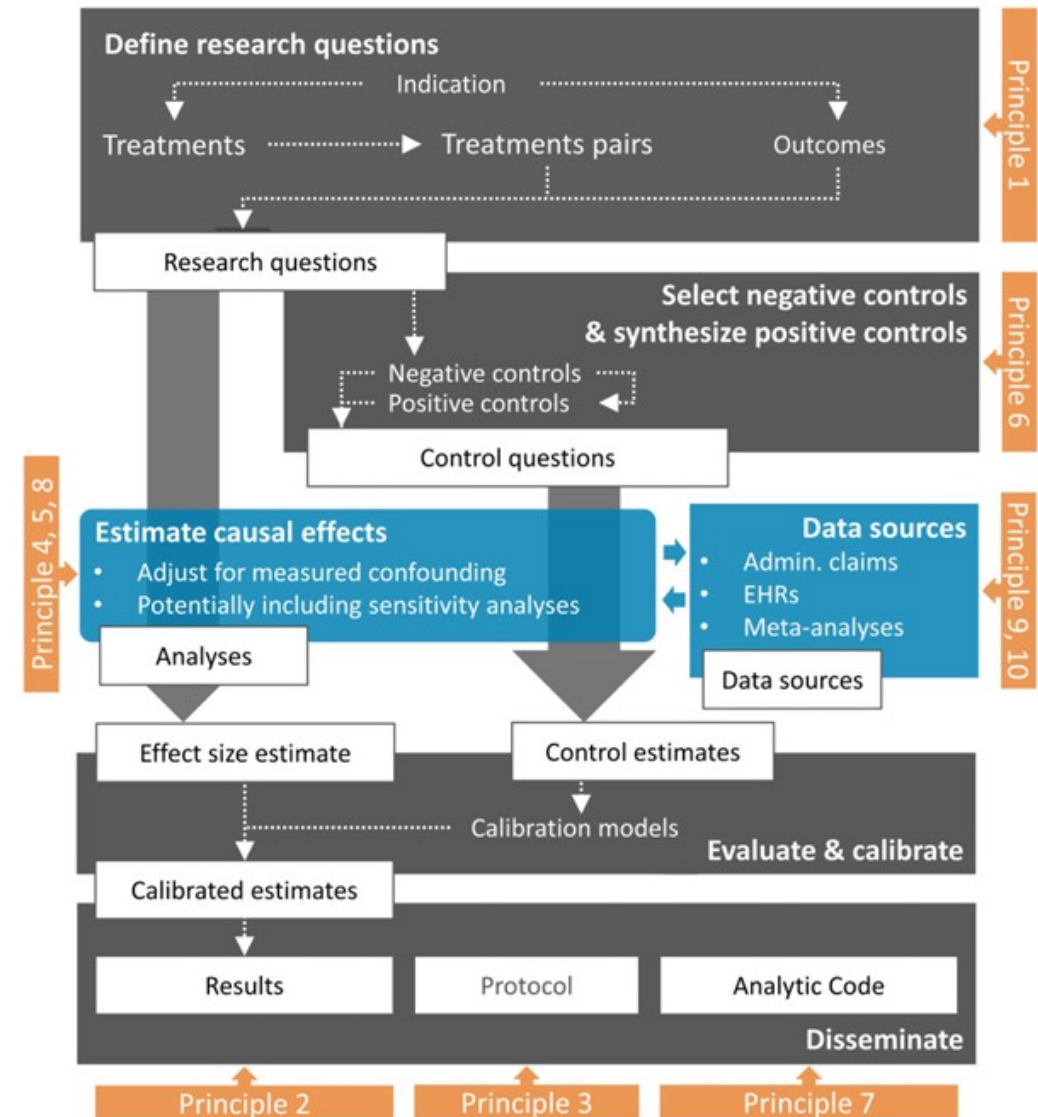
LEGEND principles

1. LEGEND will generate evidence at a large scale.

2. Dissemination of the evidence will not depend on the estimated effects.

3. LEGEND will generate evidence using a prespecified analysis design.

4. LEGEND will generate evidence by consistently applying a systematic process across all research questions.

5 LEGEND will generate evidence using best practices.

6. LEGEND will include empirical evaluation through the use of control questions.

7. LEGEND will generate evidence using open-source software that is freely available to all.

8. LEGEND will not be used to evaluate new methods.

9. LEGEND will generate evidence across a network of multiple databases.

10. LEGEND will maintain data confidentiality; patient-level data will not be shared between sites in the network.
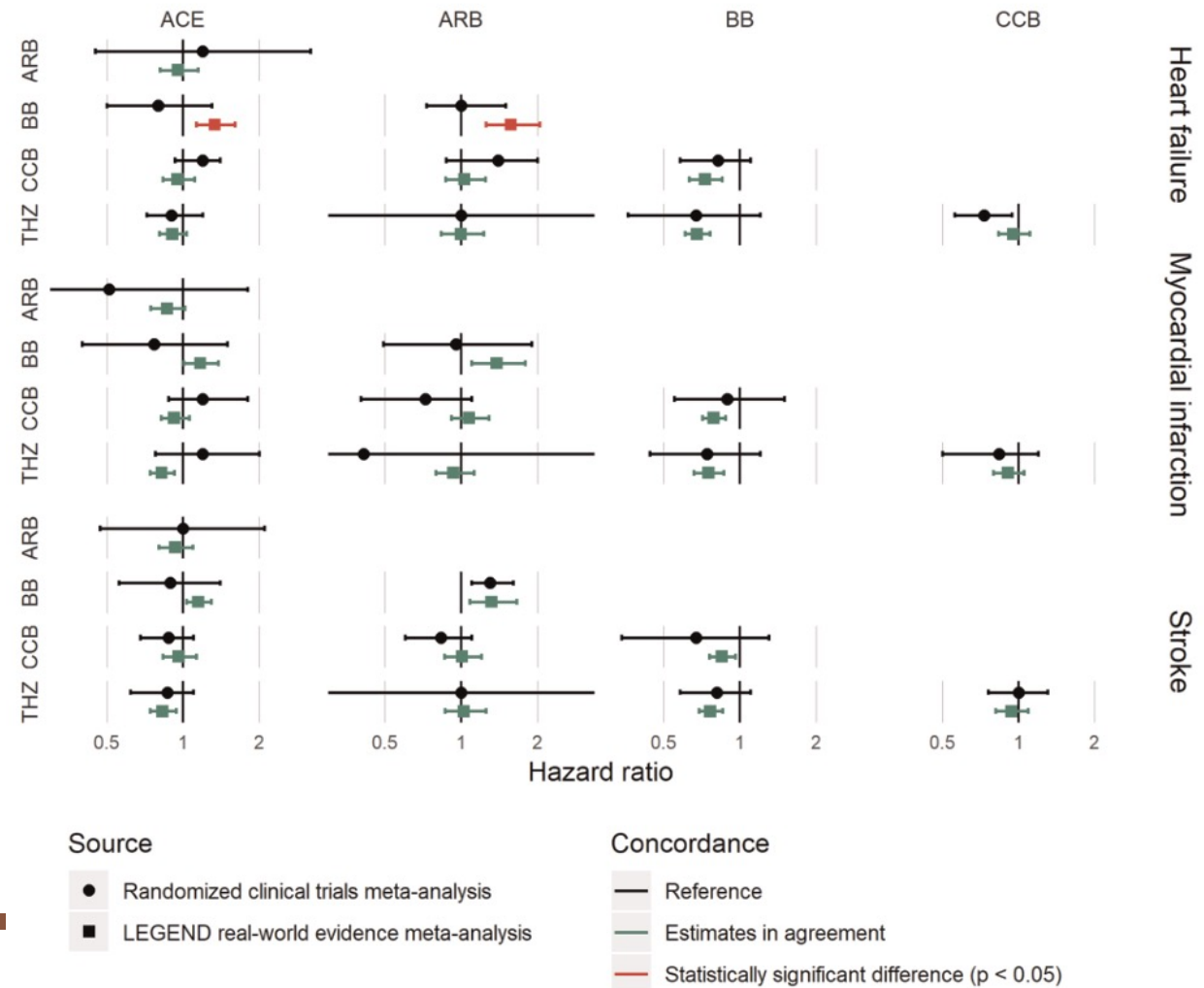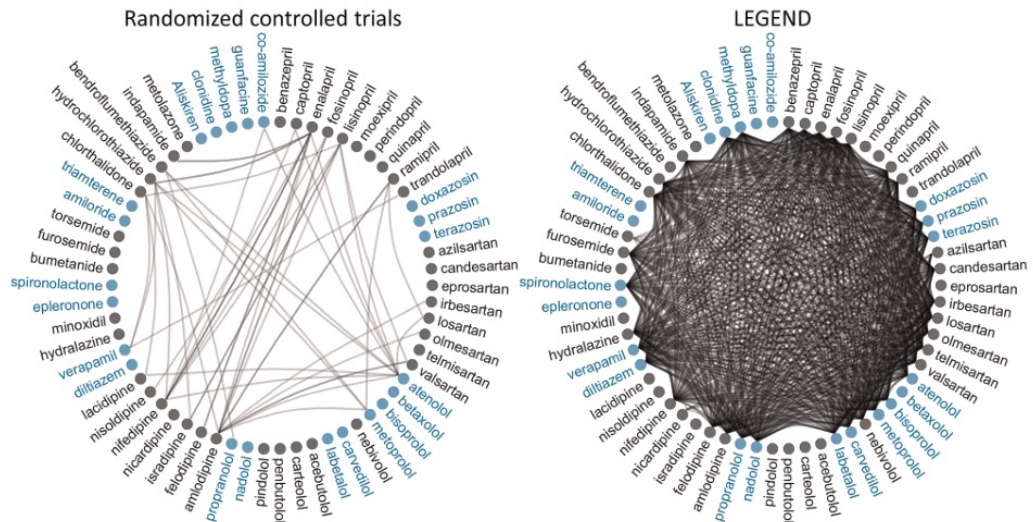
Verified and open

Validating LEGEND

Figure 3. Comparisons of single-drug hypertension treatments in randomized controlled trials (left) and in LEGEND (right). Each circle represents an ingredient. Color groupings indicate drug classes. A line between circles indicates the 2 drugs are compared in at least 1 study.

Table 18. Oral Antihypertensive Drugs

Class	Drug	Usual Dose, Range (mg/d)*	Daily Frequency	Comments
Primary agents				
Thiazide or thiazide-type diuretics	Chlorthalidone	12.5–25	1	• Chlorthalidone is preferred on the basis of prolonged half-life and proven trial reduction of CVD. • Monitor for hyponatremia and hypokalemia, uric acid and calcium levels. • Use with caution in patients with history of acute gout unless patient is on uric acid–lowering therapy.
	Hydrochlorothiazide	25–50	1	
	Indapamide	1.25–2.5	1	
	Metolazone	2.5–10	1	
ACE inhibitors	Benazepril	10–40	1 or 2	• Do not use in combination with ARBs or direct renin inhibitor. • There is an increased risk of hyperkalemia, especially in patients with CKD or in those on K^+ supplements or K^+-sparing drugs. • There is a risk of acute renal failure in patients with severe bilateral renal artery stenosis. • Do not use if patient has history of angioedema with ACE inhibitors. • Avoid in pregnancy.
	Captopril	12.5–150	2 or 3	
	Enalapril	5–40	1 or 2	
	Fosinopril	10–40	1	
	Lisinopril	10–40	1	
	Moexipril	7.5–30	1 or 2	
	Perindopril	4–16	1	
	Quinapril	10–80	1 or 2	
	Ramipril	2.5–10	1 or 2	
	Trandolapril	1–4	1	
ARBs	Azilsartan	40–80	1	• Do not use in combination with ACE inhibitors or direct renin inhibitor. • There is an increased risk of hyperkalemia in CKD or in those on K^+ supplements or K^+-sparing drugs. • There is a risk of acute renal failure in patients with severe bilateral renal artery stenosis. • Do not use if patient has history of angioedema with ARBs. Patients with a history of angioedema with an ACE inhibitor can receive an ARB beginning 6 weeks after ACE inhibitor is discontinued. • Avoid in pregnancy.
	Candesartan	8–32	1	
	Eprosartan	600–800	1 or 2	
	Irbesartan	150–300	1	
	Losartan	50–100	1 or 2	
	Olmesartan	20–40	1	
	Telmisartan	20–80	1	
	Valsartan	80–320	1	
CCB— dihydropyridines	Amlodipine	2.5–10	1	• Avoid use in patients with HFrEF; amlodipine or felodipine may be used if required. • They are associated with dose-related pedal edema, which is more common in women than men.
	Felodipine	5–10	1	
	Isradipine	5–10	2	
	Nicardipine SR	5–20	1	
	Nifedipine LA	60–120	1	
	Nisoldipine	30–90	1	
CCB— nondihydropyridines	Diltiazem SR	180–360	2	• Avoid routine use with beta blockers because of increased risk of bradycardia and heart block. • Do not use in patients with HFrEF. • There are drug interactions with diltiazem and verapamil (CYP3A4 major substrate and moderate inhibitor).
	Diltiazem ER	120–480	1	
	Verapamil IR	40-80	3	
	Verapamil SR	120–480	1 or 2	
	Verapamil-delayed onset ER (various forms)	100–480	1 (in the evening)	

Whelton et al., Hypertension 2018

Chlorthalidone vs hydrochlorthiazide

- Hydrochlorothiazide is the most used
  - Used to teach that HCTZ's limited duration (20h) helped the kidney
- Physiology
  - Chlorthalidone is longer lasting (and more potent)
- Indirect (network) meta-analysis favored chlorthalidone
  - Combine RCT results
  - Bias: heterogeneity of treatment effect + different populations
  - Also: differential RCT design and execution
- Old observational studies showed no effect or limited benefit chlorthaladone
  - Wrong dose, reuse of old data
- Recent observational research favored HCTZ (Dhalla)

What would the 'target trial' look like to compare efficacy of two initial therapies?
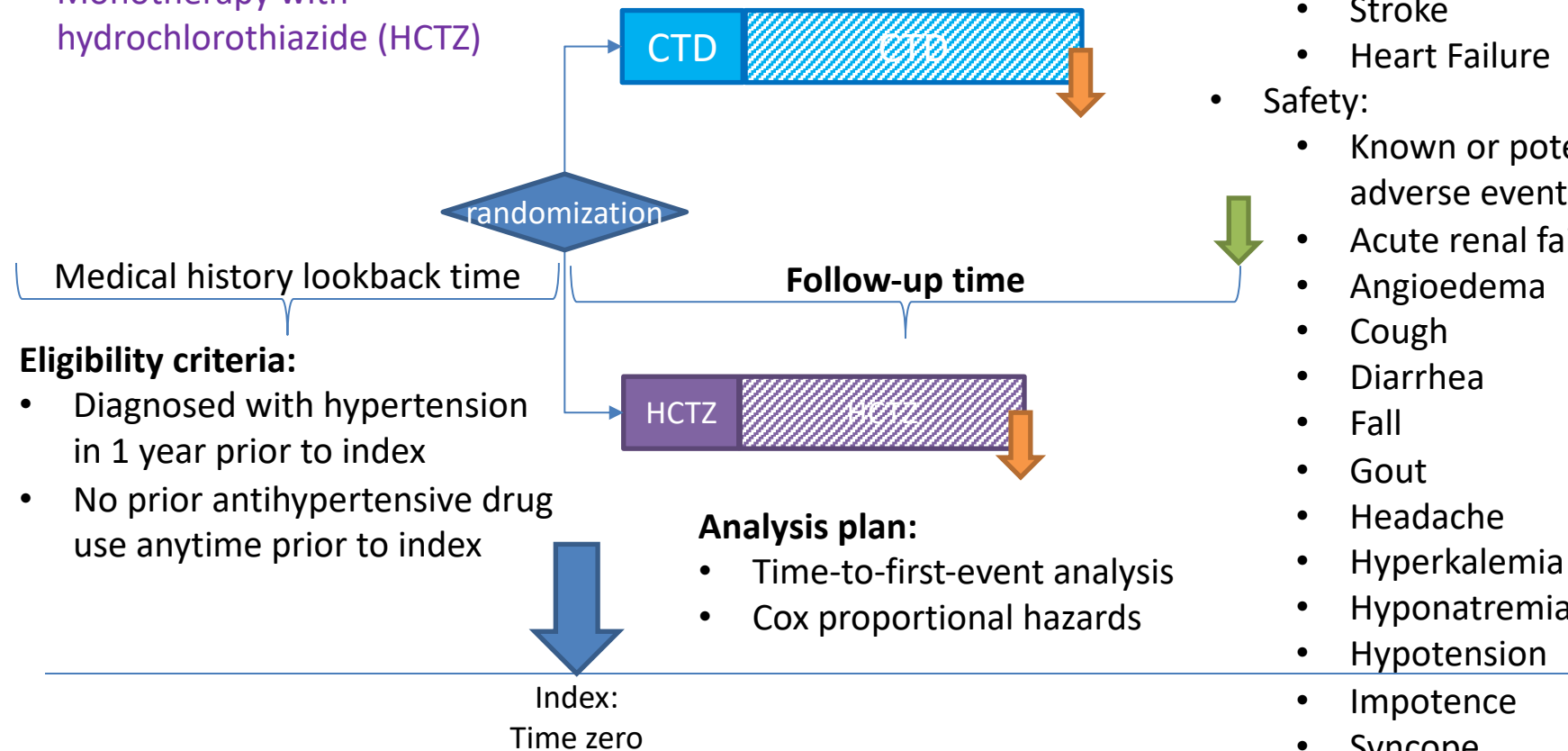
Treatment strategies:
- Monotherapy with chlorthalidone (CTD)
- Monotherapy with hydrochlorothiazide (HCTZ)

Causal contrasts of interest:
- Intent-to-treat effect
- On-treatment effect

Outcomes:
- Efficacy:
  - Myocardial infarction
  - Stroke
  - Heart Failure
- Safety:
  - Known or potential adverse events, e.g.
  - Acute renal failure
  - Angioedema
  - Cough
  - Diarrhea
  - Fall
  - Gout
  - Headache
  - Hyperkalemia
  - Hyponatremia
  - Hypotension
  - Impotence
  - Syncope
  - Vertigo

CTD

randomization

HCTZ

Medical history lookback time

Follow-up time

Eligibility criteria:
- Diagnosed with hypertension in 1 year prior to index
- No prior antihypertensive drug use anytime prior to index

Analysis plan:
- Time-to-first-event analysis
- Cox proportional hazards

Index:
Time zero

What is the Diuretic Comparison Project study design?
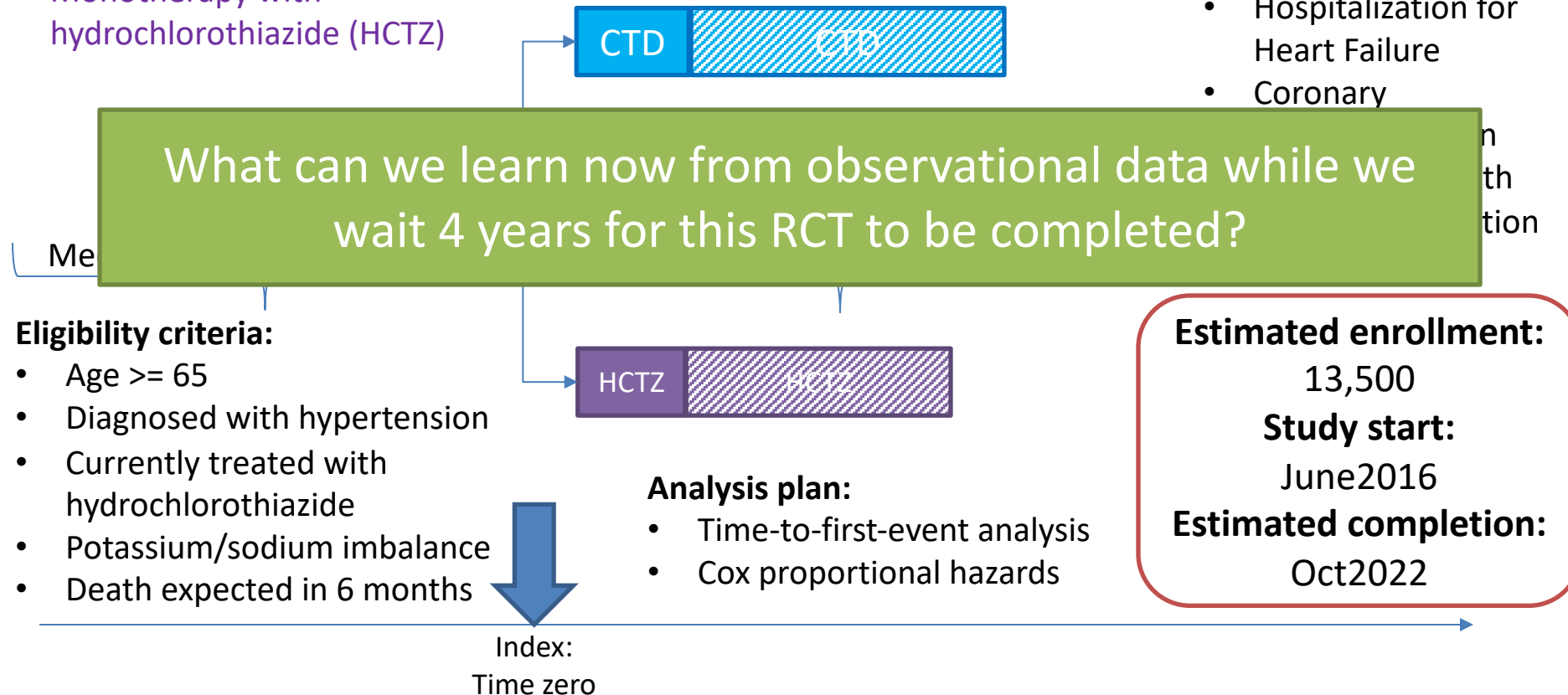
Treatment strategies:
- Monotherapy with chlorthalidone (CTD)
- Monotherapy with hydrochlorothiazide (HCTZ)

Causal contrasts of interest:
- Intent-to-treat effect

Outcomes:
- Myocardial infarction
- Stroke
- Hospitalization for Heart Failure
- Coronary

CTD CTD

What can we learn now from observational data while we wait 4 years for this RCT to be completed?

Me

Eligibility criteria:
- Age >= 65
- Diagnosed with hypertension
- Currently treated with hydrochlorothiazide
- Potassium/sodium imbalance
- Death expected in 6 months

HCTZ HCTZ

Analysis plan:
- Time-to-first-event analysis
- Cox proportional hazards

Estimated enrollment:
13,500
Study start:
June2016
Estimated completion:
Oct2022

Index:
Time zero

https://clinicaltrials.gov/ct2/show/NCT02185417

Chlorthalidone vs hydrochlorthiazide

17 Feb 2020

Comparison of Cardiovascular and Safety Outcomes of Chlorthalidone vs Hydrochlorothiazide to Treat Hypertension

George Hripcsak, MD, MS; Marc A. Suchard, MD, PhD; Steven Shea, MD; RuiJun Chen, MD; Seng Chan You, MD; Nicole Pratt, PhD; David Madigan, PhD; Harlan M. Krumholz, MD, SM; Patrick B. Ryan, PhD; Martijn J. Schuemie, PhD

+ Supplemental content

IMPORTANCE Chlorthalidone is currently recommended as the preferred thiazide diuretic to treat hypertension, but no trials have directly compared risks and benefits.

OBJECTIVE To compare the effectiveness and safety of chlorthalidone and hydrochlorothiazide as first-line therapies for hypertension in real-world practice.

DESIGN, SETTING, AND PARTICIPANTS This is a Large-Scale Evidence Generation and Evaluation in a Network of Databases (LEGEND) observational comparative cohort study with large-scale propensity score stratification and negative-control and synthetic positive-control calibration on databases spanning January 2001 through December 2018. Outpatient and inpatient care episodes of first-time users of antihypertensive monotherapy in the United States based on 2 administrative claims databases and 1 collection of electronic health records were analyzed. Analysis began June 2018.

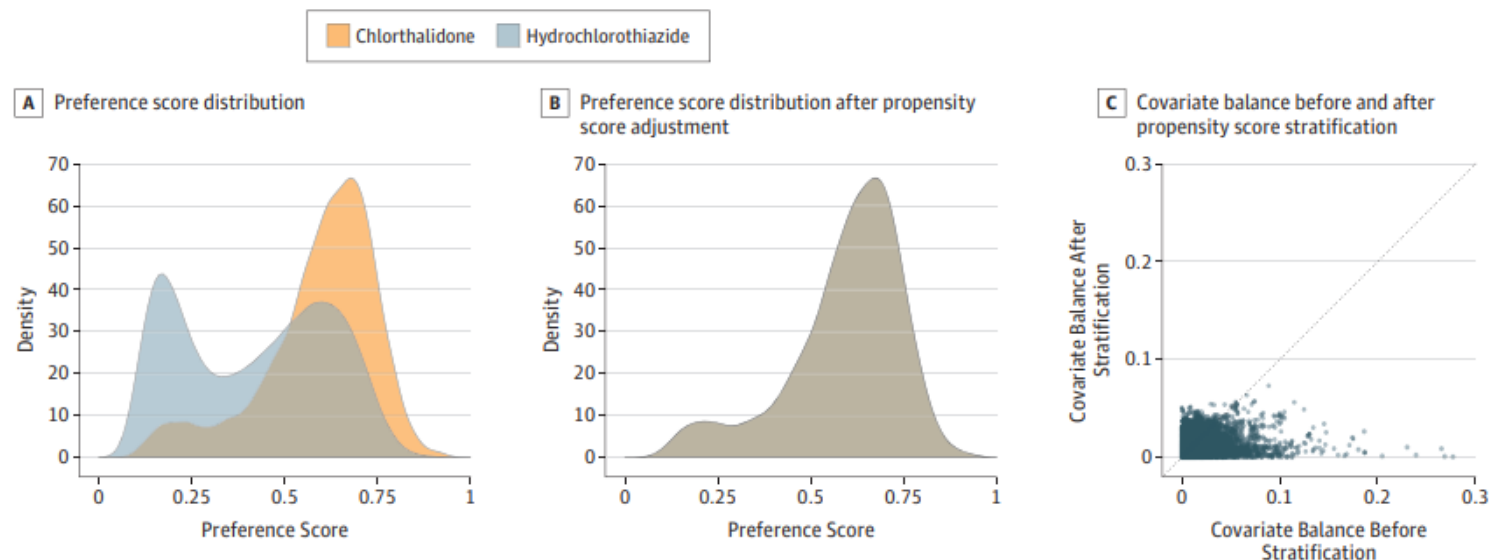**JAMA Internal Medicine | Original Investigation**

Comparison of Cardiovascular and Safety Outcomes of Chlorthalidone vs Hydrochlorothiazide to Treat Hypertension

George Hripcsak, MD, MS; Marc A. Suchard, MD, PhD; Steven Shea, MD; RuiJun Chen, MD;
Seng Chan You, MD; Nicole Pratt, PhD; David Madigan, PhD; Harlan M. Krumholz, MD, SM

Figure 1. Comparability of the Populations for Commercial Claims and Encounters Database (CCAE)

Legend: Chlorthalidone / Hydrochlorothiazide

A. Preference score distribution
B. Preference score distribution after propensity score adjustment
C. Covariate balance before and after propensity score stratification

Figure 2. Homogeneity on Effectiveness

Source	Uncalibrated HR (95% CI)	Calibrated HR (95% CI)
CCAE	0.96 (0.70-1.29)	0.96 (0.72-1.29)
Optum	1.00 (0.76-1.28)	1.04 (0.81-1.33)
PanTher	1.10 (0.79-1.49)	1.00 (0.75-1.36)
Summary (I^2 <0.01)	1.01 (0.86-1.20)	1.00 (0.85-1.17)

Favors Chlorthalidone — Favors Hydrochlorothiazide

Uncalibrated, HR (95% CI) — Calibrated, HR (95% CI)

Hazard ratios (HRs) and forest plot of the 3 databases and the meta-analysis for chlorthalidone vs hydrochlorothiazide on the composite cardiovascular disease outcome. The 3 databases showed excellent agreement. CCAE indicates Commercial Claims and Encounters Database.

eFigure 2. Sensitivity to balancing on baseline blood pressure in the PanTher database. We show effectiveness and safety outcomes for the PanTher database for propensity models that exclude (blue triangle) and include (red circle) baseline systolic and diastolic blood pressure in the propensity model. There are no major shifts in outcome.
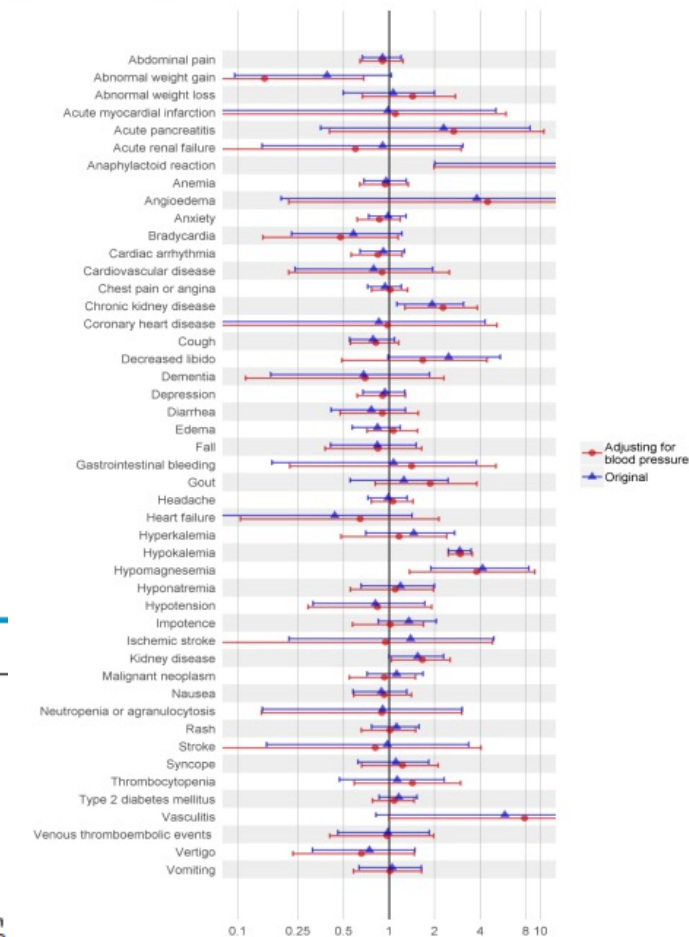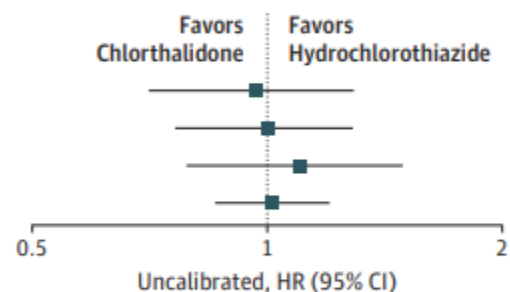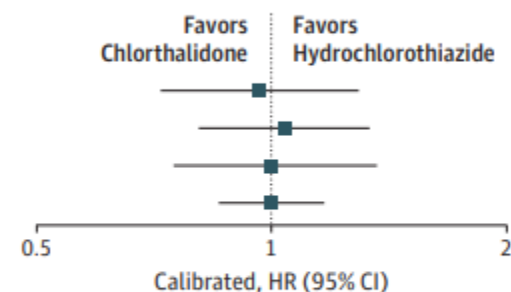
Legend: Adjusting for blood pressure / Original

Chlorthalidone vs hydrochlorthiazide: no detected difference in effectiveness

17 Feb 2020

JAMA Internal Medicine | Original Investigation

Comparison of Cardiovascular and Safety Outcomes of Chlorthalidone vs Hydrochlorothiazide to Treat Hypertension

George Hripcsak, MD, MS; Marc A. Suchard, MD, PhD; Steven Shea, MD; RuiJun Chen, MD; Seng Chan You, MD; Nicole Pratt, PhD; David Madigan, PhD; Harlan M. Krumholz, MD, SM; Patrick B. Ryan, PhD; Martijn J. Schuemie, PhD

Table 2. Effectiveness by Outcome (Propensity Score Stratification, On-Treatment)

Outcome	Chlorthalidone, Total No.		Hydrochlorothiazide, No. (%)		Hazard Ratio (95% CI)[a]	
	Events	Patients[b]	Events	Patients[b]	Uncalibrated	Calibrated
Acute myocardial infarction	41	36 859	952	692 371	0.93 (0.63-1.36)	0.92 (0.64-1.31)
Hospitalization for heart failure	62	36 833	1248	691 409	1.07 (0.82-1.39)	1.05 (0.82-1.34)
Stroke	60	36 755	1141	689 698	1.13 (0.86-1.47)	1.10 (0.86-1.41)
Composite cardiovascular disease[c]	149	36 628	3089	687 106	1.01 (0.86-1.20)	1.00 (0.85-1.17)

[a] Hazard ratio for chlorthalidone vs hydrochlorothiazide (lower hazard ratio favors chlorthalidone).

[b] Number of patients exposed varies by outcome owing to differences in whether database has hospitalization information and outcome-specific preexposure exclusions.
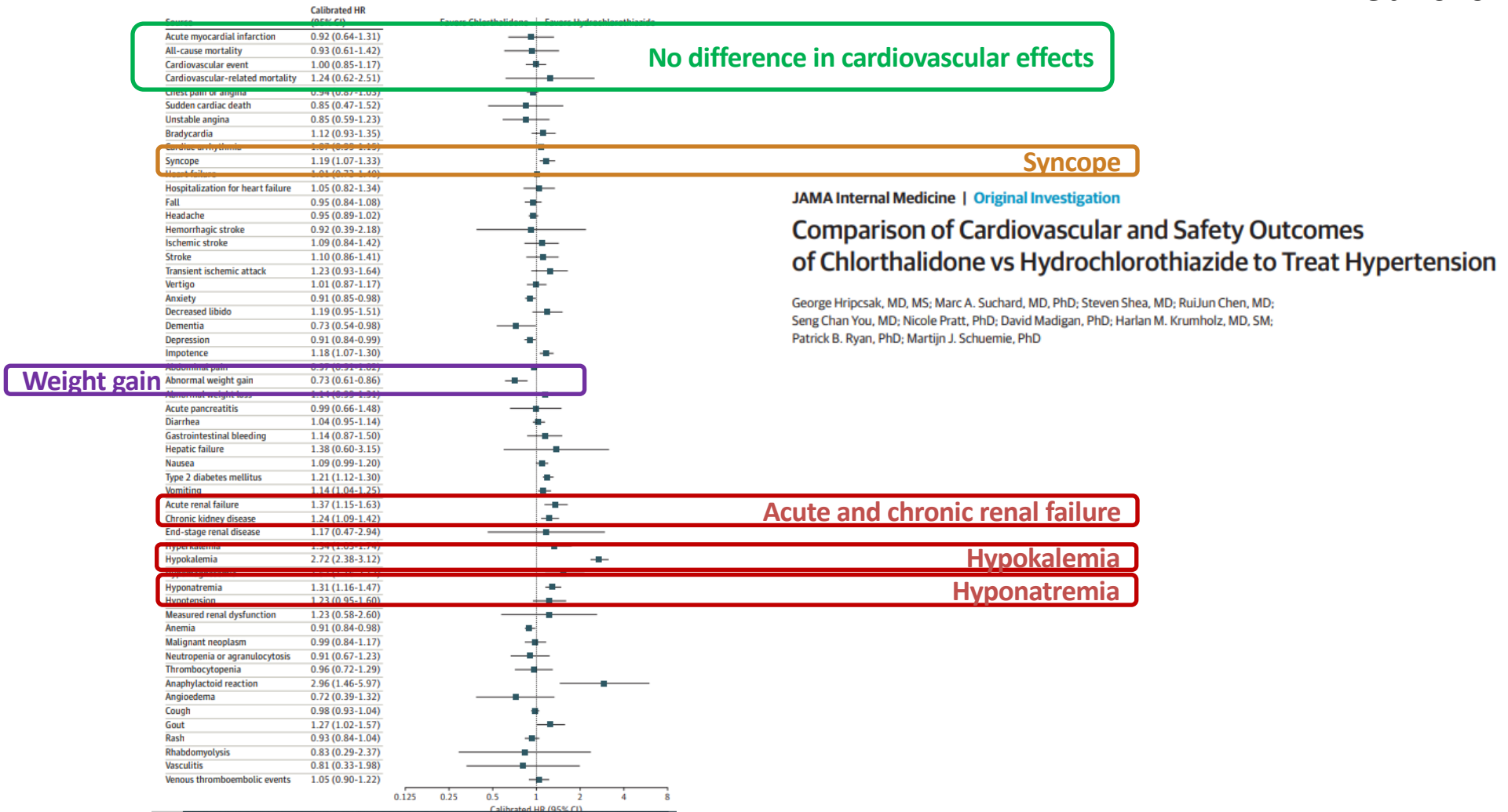
[c] Composite cardiovascular disease includes the first 3 outcomes and sudden cardiac death.

Safety favors HCTZ – electrolyte, renal Chlorthalidone longer acting, potent

17 Feb 2020

Figure 3. Forest Plot of Safety and Effectiveness Outcomes

JAMA Internal Medicine | Original Investigation

Comparison of Cardiovascular and Safety Outcomes of Chlorthalidone vs Hydrochlorothiazide to Treat Hypertension

George Hripcsak, MD, MS; Marc A. Suchard, MD, PhD; Steven Shea, MD; RuiJun Chen, MD; Seng Chan You, MD; Nicole Pratt, PhD; David Madigan, PhD; Harlan M. Krumholz, MD, SM; Patrick B. Ryan, PhD; Martijn J. Schuemie, PhD

Chlorthalidone and Hydrochlorothiazide for Treatment of Patients With Hypertension

Andrew E. Moran, MD, MPH[1,2]; Paul K. Whelton, MD, MSc[3]; Thomas R. Frieden, MD, MPH[1]

Chlorthalidone and Hydrochlorothiazide for Treatment of Patients With Hypertension

To the Editor Hripcsak et al[1] compared cardiovascular and safety outcomes of chlorthalidone and hydrochlorothiazide in the treatment of patients with hypertension. Chlorthalidone is recommended over hydrochlorothiazide because it has a longer duration of effect (24 vs 6-12 hours) and has been more extensively documented as effective in randomized clinical trials to reduce cardiovascular events and mortality.[2] Prior meta-analyses and observational comparisons suggest that chlorthalidone is superior in preventing cardiovascular events.[3,4] However, to our knowledge there are no published randomized trials comparing chlorthalidone and hydrochlorothiazide; such a trial is ongoing in the US Veterans Affairs system, with results expected in 2023.[5]

Moderately strong prior evidence suggests the superiority of chlorthalidone over hydrochlorothiazide, and there is substantial likelihood that residual confounding accounts for the lack of an observed difference in cardiovascular end points in the Hripcsak et al[1] study. For this reason, it is imperative to await the more definitive VA trial results in 2023[5] before changing clinical practice recommendations on diuretic choice.

Andrew E. Moran, MD, MPH
Paul K. Whelton, MD, MSc
Thomas R. Frieden, MD, MPH

The NEW ENGLAND JOURNAL of MEDICINE

Chlorthalidone vs. Hydrochlorothiazide for Hypertension–Cardiovascular Events

Areef Ishani, M.D., William C. Cushman, M.D., Sarah M. Leatherman, Ph.D., Robert A. Lew, Ph.D.,
Patricia Woods, M.S.N., R.N., Peter A. Glassman, M.B., B.S., Addison A. Taylor, M.D., Cynthia Hau, M.P.H.,
Alison Klint, M.S., Grant D. Huang, Ph.D., M.P.H., Mary T. Brophy, M.D., M.P.H., Louis D. Fiore, M.D., M.P.H.,
and Ryan E. Ferguson, Sc.D., M.P.H., for the Diuretic Comparison Project Writing Group*

ABSTRACT

BACKGROUND

Whether chlorthalidone is superior to hydrochlorothiazide for preventing major adverse cardiovascular events in patients with hypertension is unclear.

METHODS

In a pragmatic trial, we randomly assigned adults 65 years of age or older who were patients in the Department of Veterans Affairs health system and had been receiving hydrochlorothiazide at a daily dose of 25 or 50 mg to continue therapy with hydrochlorothiazide or to switch to chlorthalidone at a daily dose of 12.5 or 25 mg. The primary outcome was a composite of nonfatal myocardial infarction, stroke, heart failure resulting in hospitalization, urgent coronary revascularization for unstable angina, and non–cancer-related death. Safety was also assessed.

RESULTS

A total of 13,523 patients underwent randomization. The mean age was 72 years. At baseline, hydrochlorothiazide at a dose of 25 mg per day had been prescribed in 12,781 patients (94.5%). The mean baseline systolic blood pressure in each group was 139 mm Hg. At a median follow-up of 2.4 years, there was little difference in the occurrence of primary-outcome events between the chlorthalidone group (702 patients [10.4%]) and the hydrochlorothiazide group (675 patients [10.0%]) (hazard ratio, 1.04; 95% confidence interval, 0.94 to 1.16; P=0.45). There were no between-group differences in the occurrence of any of the components of the primary outcome. The incidence of hypokalemia was higher in the chlorthalidone group than in the hydrochlorothiazide group (6.0% vs. 4.4%, P<0.001).

CONCLUSIONS

In this large pragmatic trial of thiazide diuretics at doses commonly used in clinical practice, patients who received chlorthalidone did not have a lower occurrence of major cardiovascular outcome events or non–cancer-related deaths than patients who received hydrochlorothiazide. (Funded by the Veterans Affairs Cooperative Studies Program; ClinicalTrials.gov number, NCT02185417.)

From Minneapolis Veterans Affairs (VA) Health Care System, and the Department of Medicine, University of Minnesota — both in Minneapolis (A.I.); Medical Service, Memphis VA Medical Center, and the Department of Preventive Medicine, University of Tennessee Health Science Center — both in Memphis (W.C.C.); the Cooperative Studies Program Coordinating Center, VA Boston Healthcare System (S.M.L., R.A.L., P.W., C.H., A.K., M.T.B., L.D.F., R.E.F.), the Department of Biostatistics, Boston University School of Public Health (S.M.L., R.A.L.), and the Department of Medicine, Boston University School of Medicine (M.T.B., R.E.F.) — all in Boston; Pharmacy Benefits Management Services (P.A.G.) and the Office of Research and Development (G.D.H.), Department of Veterans Affairs, Washington, DC; VA Greater Los Angeles Healthcare System, and the David Geffen School of Medicine, University of California, Los Angeles — both in Los Angeles (P.A.G.); and Michael E. DeBakey VA Medical Center, and the Department of Medicine, Baylor College of Medicine — both in Houston (A.A.T.). Dr. Ishani can be contacted at areef.ishani@va.gov or at Primary and Specialty Care, Minneapolis VA Health Care System–Department of Medicine, 1 Veterans Dr., Minneapolis, MN 55417.

*A complete list of the investigators in the Diuretic Comparison Project is provided in the Supplementary Appendix, available at NEJM.org.

This article was published on December 14, 2022, at NEJM.org.

N Engl J Med 2022;387:2401-10.
DOI: 10.1056/NEJMoa2212270

Table 2. Primary, Secondary, and Safety Outcomes.*

Outcome	Chlorthalidone (N=6756)	Hydrochlorothiazide (N=6767)	Hazard Ratio (95% CI)†
Primary composite outcome — no. (%)‡	702 (10.4)	675 (10.0)	1.04 (0.94–1.16)§
Secondary outcomes: components of the primary outcome — no. (%)			
MI	142 (2.1)	140 (2.1)	1.02 (0.80–1.28)
Stroke	83 (1.2)	83 (1.2)	1.00 (0.74–1.36)
Hospitalization due to heart failure	242 (3.6)	232 (3.4)	1.04 (0.87–1.25)
Unstable angina leading to urgent coronary revascularization	20 (0.3)	13 (0.2)	1.54 (0.77–3.10)
Non–cancer-related death	359 (5.3)	354 (5.2)	1.01 (0.88–1.17)
Death from any cause — no. (%)	446 (6.6)	448 (6.6)	1.00 (0.87–1.13)
Expected adverse events — no. (%)			
New allergic or adverse reaction to thiazide-type diuretic	109 (1.6)	21 (0.3)	5.23 (3.28–8.35)
Hypokalemia	406 (6.0)	298 (4.4)	1.38 (1.19–1.60)
As primary cause of hospitalization	98 (1.5)	73 (1.1)	1.35 (1.00–1.82)
Potassium level <3.1 mmol/liter	335 (5.0)	243 (3.6)	1.39 (1.18–1.64)
Hospitalization for acute kidney injury	495 (7.3)	512 (7.6)	0.95 (0.85–1.09)

Comparing LEGEND real-world evidence with DCP randomized trial result

	OHDSI's LEGEND in 2018/2020	Diuretic Comparison Project RCT in 2022
Cardiovascular events	1.00 (0.85-1.17)	1.04 (0.94-1.16)
Hospitalization for Acute myocardial infarction	0.92 (0.64-1.31)	1.02 (0.80-1.28)
Hospitalization for Stroke	1.10 (0.86-1.41)	1.00 (0.74-1.36)
Hospitalization for Heart failure	1.05 (0.82-1.34)	1.04 (0.87-1.25)
Hypokalemia	2.72 (2.38-3.12)	1.38 (1.19-1.60) $p < 0.001$

HCTZ vs chlorthalidone

29 Dec 2022

- VA Diuretic Comparison Project
  - Same effectiveness
  - Worse hypokalemia
  - Confirms our results
  - Different question: of patients tolerating HCTZ, should they switch to chlorthalidone

The NEW ENGLAND JOURNAL of MEDICINE

EDITORIALS

Thiazide-like versus Thiazide Diuretics — Finally, an Answer?

Julie R. Ingelfinger, M.D.

The treatment of hypertension has extended millions of lives since the mid-20th century, when hypotensive medications were few. Since then, with either a thiazide-like or thiazide diuretic is not as common as in previous eras. Yet, seemingly straightforward questions regarding the

results suggest that chlorthalidone therapy remains a good choice for hypertension despite the secondary observation that hypokalemia was more common with chlorthalidone than with hydrochlorothiazide. Although a subgroup analy-

Concluding thoughts

- Establishing value of real-world evidence is a reasonable vision, which requires building trust across evidence generators and consumers

- People and processes need to be augmented with science, technology, and engineering

- We need **large-scale evidence generation** and **large-scale collaboration**
  - Data network standardization and quality assessment
  - Standardized analytic tool development
  - Methodological benchmarks and objective diagnostics
  - Phenotype development and evaluation

- Open science systems that promote transparency (open and verified) can increase reliability and efficiency

The HowOften characterization workshop this weekend addresses large-scale evidence generation and large-scale collaboration

Support The Journey

The OHDSI community is comprised of a global team of volunteers who collaborate together using open-source tools and shared best practices to support our shared mission of generating real-world evidence that promotes better health decisions and better care.

In order to foster growth in our community of nearly 3,500 volunteers across six continents, the OHDSI Coordinating Center at Columbia University has created a sponsorship program. This program allows both corporations and individuals to make meaningful contributions in support of OHDSI's central coordinating activities. There are three levels of support, including donation amount and benefits to the sponsor, detailed below. Any level of support enhances both our community and our mission.

If you are interested, please reach out to sponsorship@ohdsi.org.

Gold Sponsorship · Donation Level: US $500k/year

- Your logo will be placed on our OHDSI Sponsors page (under Gold Level Sponsors heading) with link to your home page
- Use of OHDSI Gold Sponsor logo on your site
- Joint press release with OHDSI
- Annual meeting with OHDSI leadership to learn about current and future initiatives, and 1participate in an OHDSI sponsor Q&A session
- Weekly logo placement on title slide of OHDSI community call (average >=180 attendees per week)
- Sponsors Spotlight feature (Q&A with a member of your organization) placed on website and newsletter
- Monthly recognition on OHDSI Twitter (2800+ followers) and LinkedIn (5500+) pages
- Inclusion in "Thank You Sponsors" graphic in all OHDSI monthly newsletters (4200+ on mailing list)
- Listing in all OHDSI annual reports: Our Journey
- Recognition at all OHDSI in-person events

Silver Sponsorship · Donation Level: US $100k/year

- Your logo will be placed on our OHDSI Sponsors page (under Silver Level Sponsors heading) with link to your home page
- Use of OHDSI Silver Sponsor logo on your webpage
- Quote for your press release
- Annual meeting with OHDSI leadership to learn about current and future initiatives, and participate in an OHDSI sponsor Q&A session
- Logo placement on monthly "Thank You Sponsors" slide during OHDSI community call
- Sponsors Spotlight feature (Q&A with a member of your organization) placed on website and newsletter
- Annual recognition on OHDSI Twitter (2800+ followers) and LinkedIn (5500+) pages
- Inclusion in "Thank You Sponsors" graphic in all OHDSI monthly newsletters (4200+ on mailing list)
- Listing in all OHDSI annual reports: Our Journey
- Recognition at all OHDSI in-person events

Bronze Sponsorship · Donation Level: US $25k/year

- Your logo will be placed on our OHDSI Sponsors page (under Bronze Level Sponsors heading) with link to your home page
- Use of OHDSI Bronze Sponsor logo on your webpage
- Inclusion in "Thank You Sponsors" graphic in all OHDSI monthly newsletters (4200+ on mailing list)
- Listing in all OHDSI annual reports: Our Journey
- Recognition at all OHDSI in-person events

OHDSI Evidence Network

Clair Blacketer

Lead, CDM Workgroup
Lead, Network Data Quality Workgroup

Why are we here?
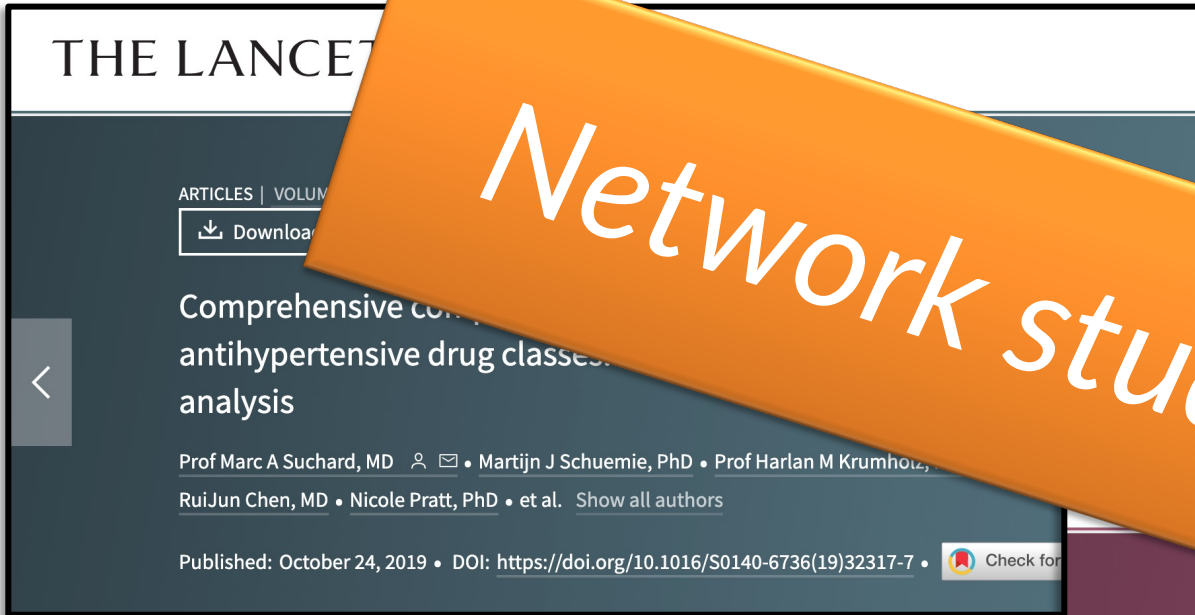

...to collaboratively generate evidence that promotes better health decisions and better care.

Why are we here?

...to collaboratively generate evidence that promotes better health decisions and better care.

Regulatory Guidelines

Considerations for the Use

- FDA recognizes that evaluation of relevant data sources or databases is an important step in the design of a study and in evaluating a study's feasibility. Such evaluations of data sources or databases for feasibility purposes serve as a way for the sponsor and FDA to (1) assess if the data source or database is fit for use to address the research question being posed and (2) estimate the statistical precision of a potential study without evaluating outcomes for treatment arms.

- Sponsors should describe in the study protocol, or as an appendix to the protocol, the data sources evaluated when designing the study, including results from feasibility evaluations or exploratory analyses of those data sources. Sponsors should provide a justification for selecting or excluding relevant data sources from the study. Sponsors should also

  describe how the choice of the final data sources, study design elements, and analytic approaches aligns with the research question of interest and that the data sources, study design elements, and analytic approaches were not selected to favor particular study findings.

What is Database Diagnostics?

Pillar #2: Standardized data network

- Opportunity: Increase transparency and maturity of OHDSI data network
- Proposed solutions:
  - Create OHDSI data network catalog to encourage network studies across interested partners and promote data quality practices
  - Generate OHDSI network concept prevalence data and make accessible for ATLAS users to enable more generalizable phenotype development
  - Promote database diagnostics by having data partners share limited subset of ACHILLES to allow for users to identify databases that satisfy study criteria

R package that allows us to determine…

…which databases have the elements required to answer a research question…

…using only a set of aggregated summary statistics.

Save our Sisyphus Challenge

Amongst people with psoriasis, does exposure to Risankizumab increase the risk of cerebrovascular events while on treatment relative to other biologic therapies?
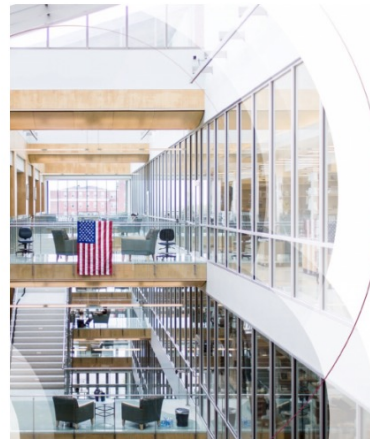Lead: Zenas Yiu

Characterization: incidence of progressive multifocal leukoencephalopathy (PML) during Multiple Sclerosis (MS) biologic exposure
Lead: Thamir Alshammary

Intravitreal Anti-VEGF and Kidney Failure
Lead: Cindy Cai

Is fluoroquinolone use really associated with the development of aortic aneurysms
Leads: Jack Janetzki, Jung Ho Kim, Seonji Kim, Jung Ah Lee, Nicole Pratt, Seng Chan You,
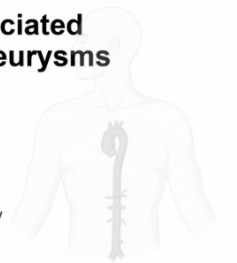
Introductory Video   Introductory Slides   Introductory Video   Introductory Slides

MS Teams Channel   GitHub Repo   MS Teams Channel   GitHub Repo

SOS Database Diagnostics Results

OHDSI Analysis Viewer

Data Diagnostic Explorer

Analysis:

- A1: aflibercept vs. bevacizumab for blinding diseases with esrd outcome
- B1: fluoroquinolone vs. cephalosporin for urinary tract infection and risk of aortic aneurysm
- C2: biologics vs disease modifying treatments for multiple sclerosis and risk of PML
- D2: risankizumab vs. tildrakizumab for psoriasis and risk of ischemic stroke

databaseId ↑	A1: aflibercept vs. bevacizumab for blinding diseases with esrd outcome	B1: fluoroquinolone vs. cephalosporin for urinary tract infection and risk of aortic aneurysm	D2: risankizumab vs. tildrakizumab for psoriasis and risk of ischemic stroke	C2: biologics vs disease modifying treatments for multiple sclerosis and risk of PML
truven_mdcd_2359_20230215	0	0	1	0
US_PharMetrics_Plus_20230330	0	0	0	0
JHM_OMOP_20230406	0	2	1	1
truven_ccae_2324_20230201	0	0	0	0
optum_ehr_2247_20221205	0	0	1	0
US_OPEN_CLAIMS_20230313	0	0	0	0
Japan_HIS_20220120	0	0	2	1
jmdc_2325_20230126	0	0	2	0
US_Hospital_20230130	0	0	2	1
CUIMC_20221214	0	2	1	0
VA-OMOP_20230411	0	2	1	0

https://data.ohdsi.org/DataDiagnostics/

Inaugural Data Sources of the OHDSI Evidence Network

Ajou University • Ajou University
Casa di Cura Igea • Casa di Cura Igea
Clinical Center of Montenegro • Clinical Center of Montenegro
Columbia University Medical Center • Columbia University Medical Center
University College London · UK THIN
IQVIA • Australia EMR
IQVIA • Disease Analyzer France
IQVIA • Disease Analyzer Germany
IQVIA • Japan Claims
IQVIA • Japan HIS
IQVIA • Longitudinal Patient Database (LPD) in Belgium
IQVIA • Longitudinal Patient Database (LPD) in France
IQVIA • Longitudinal Patient Database (LPD) in Italy
IQVIA • Longitudinal Patient Database (LPD) in Spain
IQVIA • OMOP US Hospital Data Master
IQVIA • Pharmetrics Plus
IQVIA • UK Medical Research Data EMIS
IQVIA • UK Medical Research Data THIN
IQVIA • US Open Claims
Janssen Research & Development • JMDC
Janssen Research & Development • Merative® Marketscan® Commercial Claims and Encounters
Janssen Research & Development • Merative® Marketscan® Medicare Supplemental

Janssen Research & Development • Merative® Marketscan® Multi-State Medicaid
Janssen Research & Development • Optum's Clinformatics® Data Mart - Date of Death
Janssen Research & Development • Optum's Clinformatics® Data Mart - Socio-Economic Status
Janssen Research & Development • Optum's Longitudinal EHR Repository
Janssen Research & Development • Premier Healthcare Database
Johns Hopkins University • Johns Hopkins University
National University of Singapore • National University of Singapore
Northeastern • IQVIA Pharmetrics Plus
Organization Name • Data Source Name
Taipei Medical University • Taipei Medical University
Tufts University Medical Center • Tufts University Medical Center
University of Nebraska Medical Center • University of Nebraska Medical Center
University of Southern California • Keck Medical Center
US Department of Veteran's Affairs • US Department of Veteran's Affairs
Yinzhou Bigdata Platform • Yinzhou Bigdata Platform

Join the Evidence Network and Join us on the Journey!

Acknowledgments

Frank DeFalco

Dmitry Dymshyts

Katy Sadowski

Andrew Williams

Nate Buesgens

Paul Nagy

Patrick Ryan

Martijn Scheumie

Peter Rijnbeek

Mui VanZandt

State of the Community: OHDSI Standardized Vocabularies

Alexander Davydov

Lead of the Vocabulary team

OMOP Vocabularies

Used as a central reference system for everything

- All facts in all OMOP CDM instances

- Created in 2009

- Originally contained 19 vocabularies, 656 thousand concepts

NDC — RxNorm

5 ML fulvestrant 50 MG/ML
Prefilled Syringe

concept_id = 1304049
5 ML fulvestrant 50 MG/ML Prefilled Syringe [Faslodex]

Vocabulary principles

Principle	Definition
Standard concepts	Non-duplicate concepts of fully pre-coordinated medical entities, to be stated as fact, no negations of facts, no reference to the past.
Concept domains	Assignment of concepts (rather than vocabularies) to domain categories (condition, drug, visit etc.)
Comprehensive concepts	In each domain, standard concepts must cover all possible entities
Comprehensive mapping	Mappings from terms and codes used in databases around the world
Polyhierarchies	Precalculated hierarchies organizing concepts
Efficiency	Computationally efficient data model
Simplicity	Simplicity of local implementations across the network

Vocabularies implementation

Generation

- Update public vocabularies (we adopt these)
- Create and update mapping, relationships, hierarchies
- Add new vocabularies
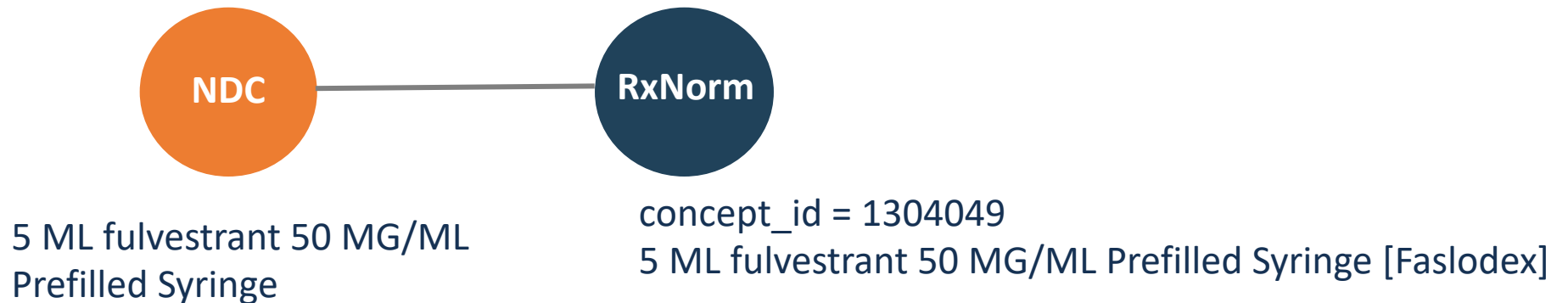- Introduce de-novo vocabularies (we don't like doing that)
- Keep up quality

Dissemination

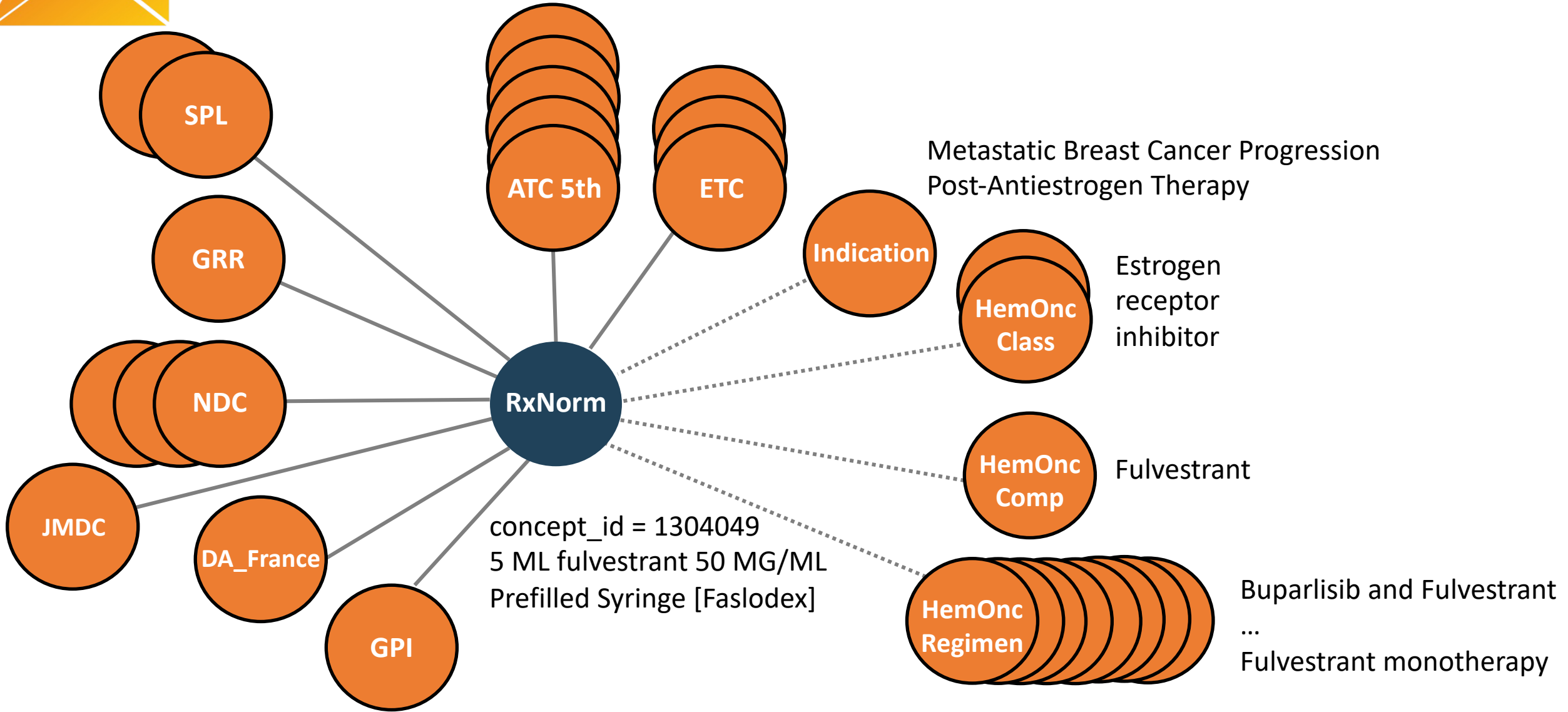- 2 releases per year: summer and winter
- Distribute through Athena

OHDSI Vocabularies in 2023

- 142 vocabularies in 44 Domains
- 11 million concepts
- 87 million ancestral and 82 million horizontal relationships

- Athena **search**: >1k unique users per day making ~67k requests per day
- Athena **subscription**: >10k total users, 2889 active users within a year
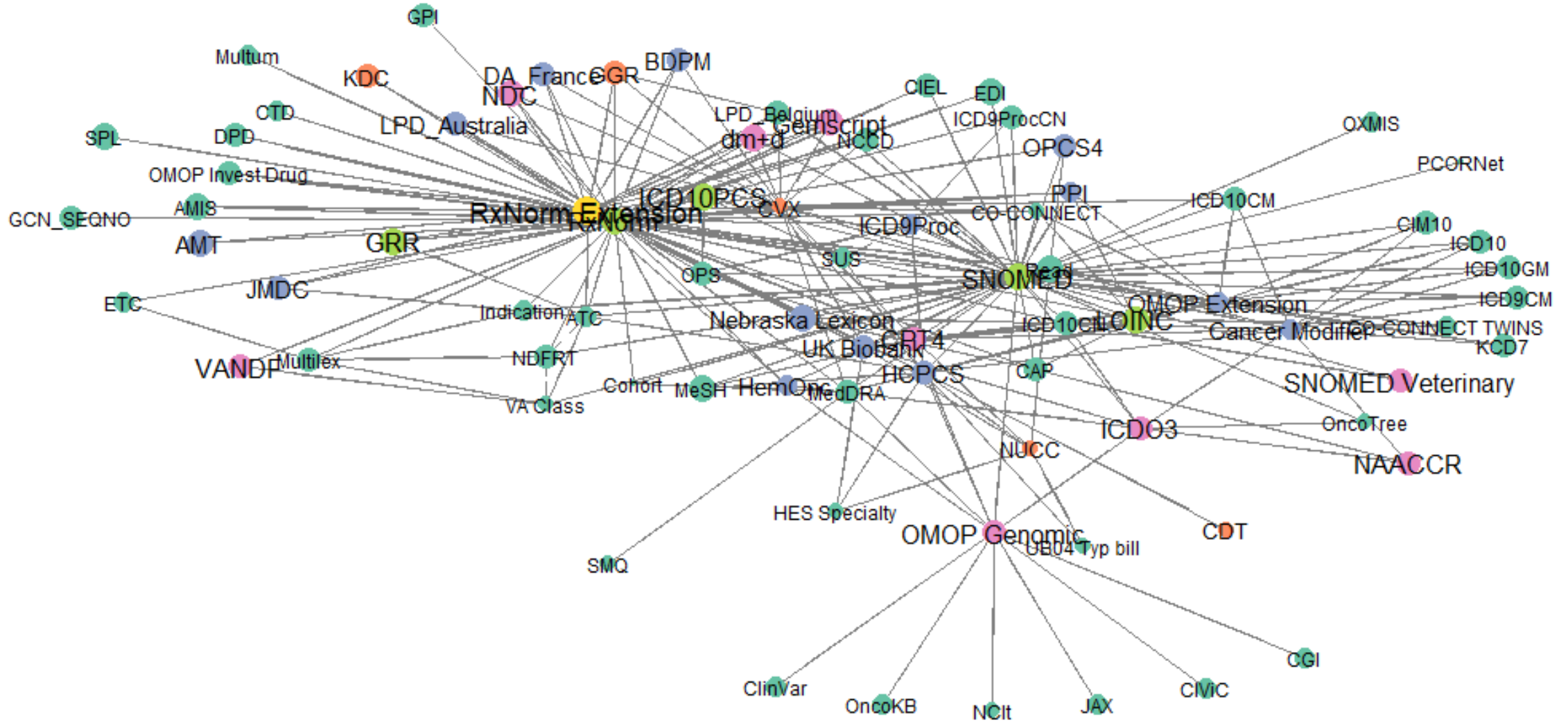- >50 downloads per day

NDC — RxNorm

5 ML fulvestrant 50 MG/ML Prefilled Syringe

concept_id = 1304049
5 ML fulvestrant 50 MG/ML Prefilled Syringe [Faslodex]

Main challenge

Main challenge

# Main solutions

- ## Alignment with the community

Systematic outreach through landscape assessment, forums, Vocab WG

- ## Focus on most important and painful points

Committee for prioritization, transparent and predictable roadmap, stable releases
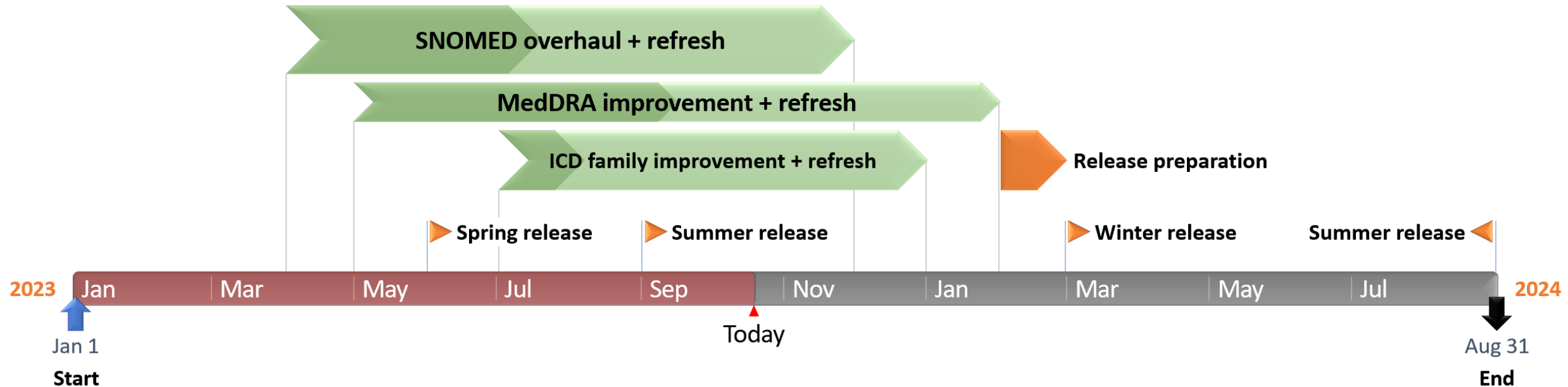
- ## Scalability

Community contributions as a pathway to accommodate community needs and build a collaborative community
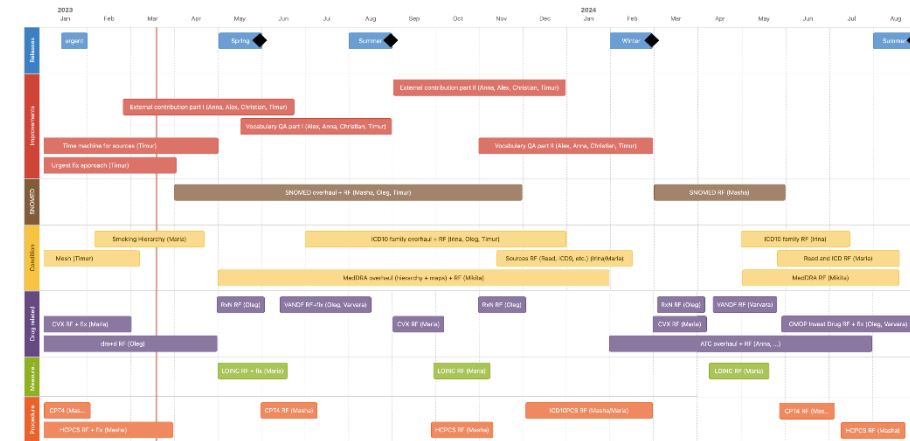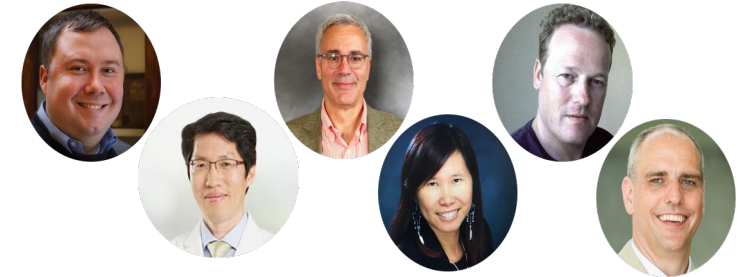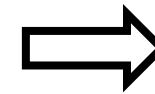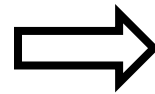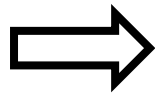
What to expect

- New roadmap timeline spent: 293/609 days (48%)

- 3 overhauls in progress (condition Domain)

- 17 vocabularies for winter release

What we need

- More engagement from the community

- We need you:
  - Use community contribution

  - Join the team and help with the work

The Team

Timur Vakhitov

Oleg Zhuk

Vlad Korsik
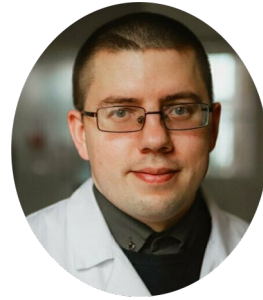
Anna Ostropolets

Maria Rogozhkina

Mikita Salavei

Varvara Savitskaya

Irina Zherka

Dmitry Buralkin

Tetiana Orlova

Tanya Skugarevskaya

Janice Cruz

Masha Khitrun

If you haven't yet realized

Alex

concept replaced by

Alexander

Sasha

concept replaced by

Alexander

OHDSI's Open Source Community

Katy Sadowski

Real World Evidence Center of Excellence, Boehringer Ingelheim

Thank you to our contributors

Adam Black, **Ajit Londhe**, **Aki Nishimura**, Aleksei Gorodetckii, Aleksei Kostiushenko, Alex Davydov, **Alexandros Rekkas**, Alexey Kostyushenko, **Alexey Manoylenko**, Andy Jensen, Anna Ostropolets, **Anna Tsvetkova**, **Anthony Sena**, Anthony Molinaro, Anton Abushkevich, **Anton Ivanov**, Antonella Delmestri, Benjamin De Boe, Benjamin Martin, chgl, **Chris Knoll**, Christian Reich, Chungsoo Kim, **Clair Blacketer**, cyanover, Dennis Soukh, Dmytry Dymshyts, DrTTrousers, Edwin Cruz, **Egill Fridgeirsson**, Eugene Zubkov, Fan Bu, **Frank DeFalco**, Frédéric De Smet, Gautam Jain, gebilaoman, Gennadiy Anisimov, George Argyriou, George Hripcsak, ginberg, **Gowtham Rao**, Henrik, Irina Zherko, Jaan Altosaar, Jacob S. Zelko, **James Wiggins**, **Jamie Gilbert**, Jamie Weaver, **Jan Blom**, Javier Gracia Tabuenca, Jen Park, **Jenna Reps**, Jianxiao Yang, Jill Hardin, jinwoo, **Joel Swerdel**, **John Gresh**, John Methot, Joris Borgdorff, Justin Bohn, Kamil Wais, **Katy Sadowski**, Kelly Li, Konstantin Yaroshovets, **Kyle Zollo-Venecek**, **Lee Evans**, Maarten van Kessel, maleman, **Marc A. Suchard**, Maria, **Martijn Schuemie**, **Martin Lavallee**, Masha Khitrun, Matthew Robinson, Max Thonagel, Maxim Moinat, mcook7272, **Mees Mosseveld**, Melanie Philofsky, Michael Gurley, Michael Kallfelz, Mikhail Iontsev, Mikita, **Nadia Kadakova**, **Nathan Buesgens**, Nathan Hall, Nurlan Umetov, Oleg Zhuk, Paul Nagy, Polina Talapova, Richard Boyce, Rob Cavanaugh, **Robert Miller**, Rowan Parry, Sergey Suvorov, Sicco, Star Liu, Thomas Falconer, Thomas White, Tim Norris, Timur Vakhitov, Troels Nielsen, Tsemharb, Varvara Savitskaya, Vlad, Vlad Korsik, Will Beasley, wivern, ww166, **Yuan Peng**, Zack Wang

Thank you to our users

- 2838 GitHub Forks

- 4168 GitHub Stars

- 5547 GitHub Subscribers

- >500k CRAN Downloads

1 Community of OHDSI Open Source Software Users

What is open source?

OHDSI open source software is developed **by the community, for the community**

- Source code is free to access, use, modify, and redistribute

- Decentralized, collaborative development process

- Focus on transparency, reliability, & auditability to support scientific use cases

All OHDSI software is freely available at **github.com/OHDSI**

ETL, CDM, Vocab. Tools

Cohort Design & Db Characterization

Analytics

Why open source?

OHDSI open source software plays a critical role in the journey from data to evidence.

- True **reproducibility** can only be achieved when the source code used to produce research results is shared

- To increase public and regulatory trust in observational research results, we must enable **openness** along *all* steps of the evidence-generation journey

- A welcoming development community fosters cross-functional **collaboration** and the exchange of ideas necessary to **innovate** in this highly complex field

- Making OHDSI tools freely available lowers financial barriers to adoption and enables the conduct of research at a massive scale

Data

Evidence

Open Source Community Workgroup

The OHDSI Open Source Community exists to promote the health and sustainability of the OHDSI open source software ecosystem.

2023 Achievements:

- Hosted 40 community members at the 2nd annual **OHDSI DevCon**

- Onboarded 21 new developers to the **Kheiron Contributor Cohort**

- Launched the OHDSI **Technical Advisory Board**

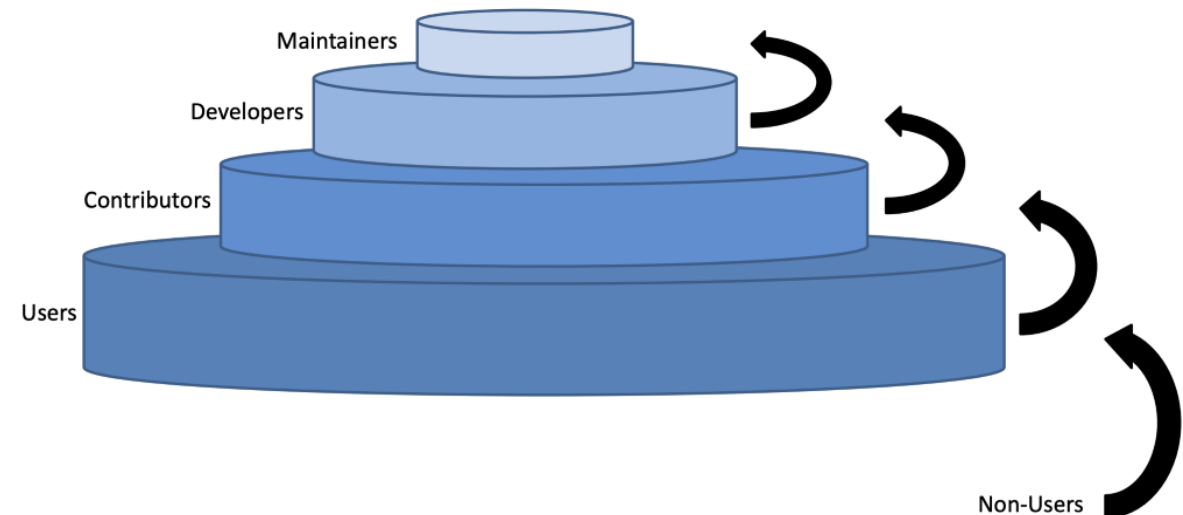- Spun out 4 platform- and tool-specific user groups

Workgroup Leads:

Paul Nagy   Adam Black

Image source: Martijn Scheumie

Technical Advisory Board

The mission of the OHDSI Technical Advisory Board is to ensure the stability, security, supportability, and sustainability of OHDSI open source projects.
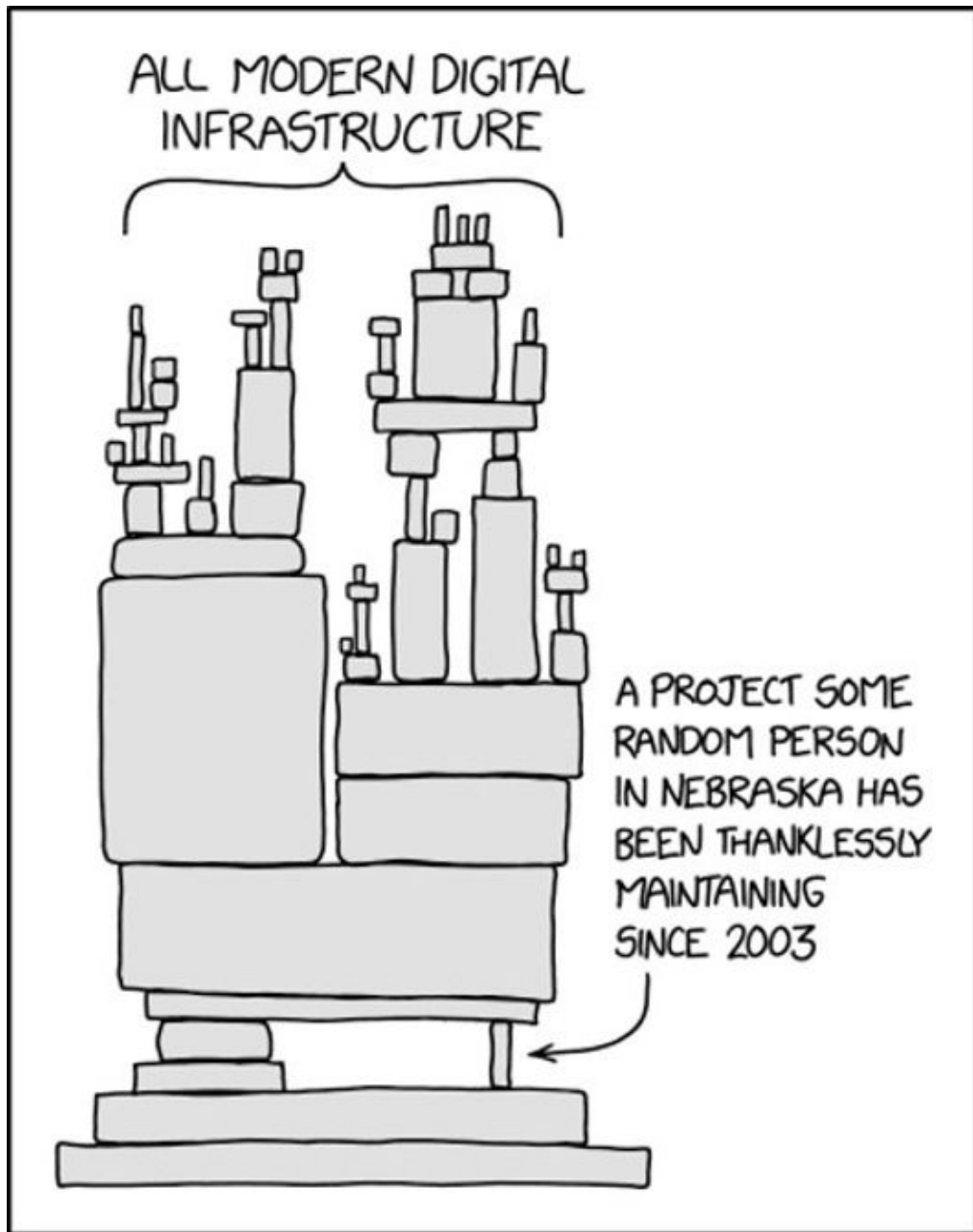
2023 Achievements:

- 14 representatives from across the OHDSI ecosystem joined the TAB and drafted a charter

- Kicked off work to:
  - Align on and implement **standards for database platform support** (including shared testing infrastructure)
  - Develop technical and process solutions for **coordinated, stable, and secure OHDSI software releases**
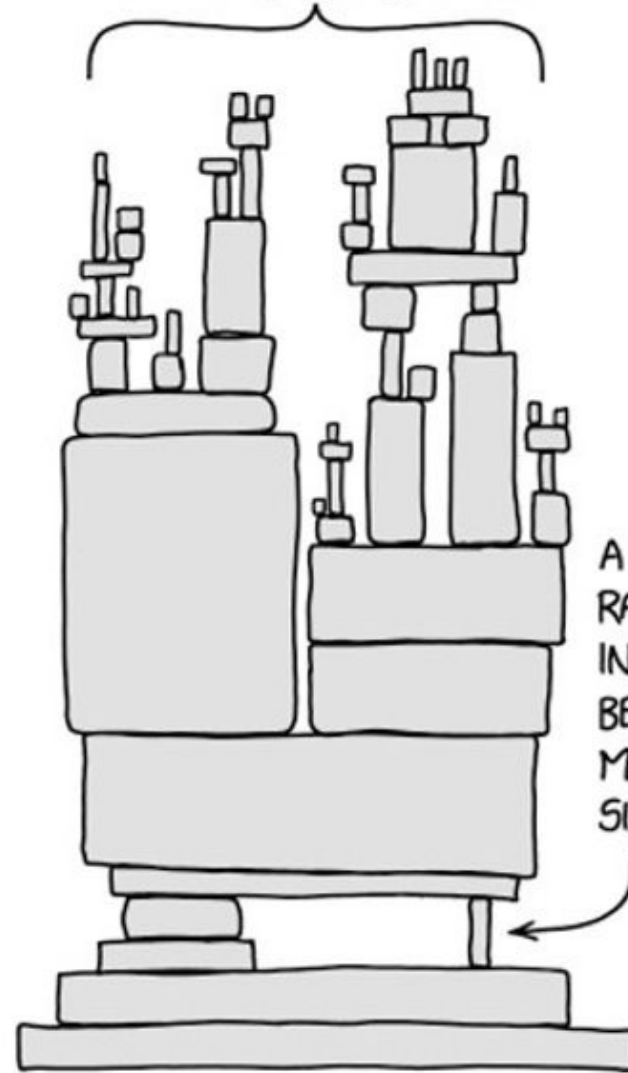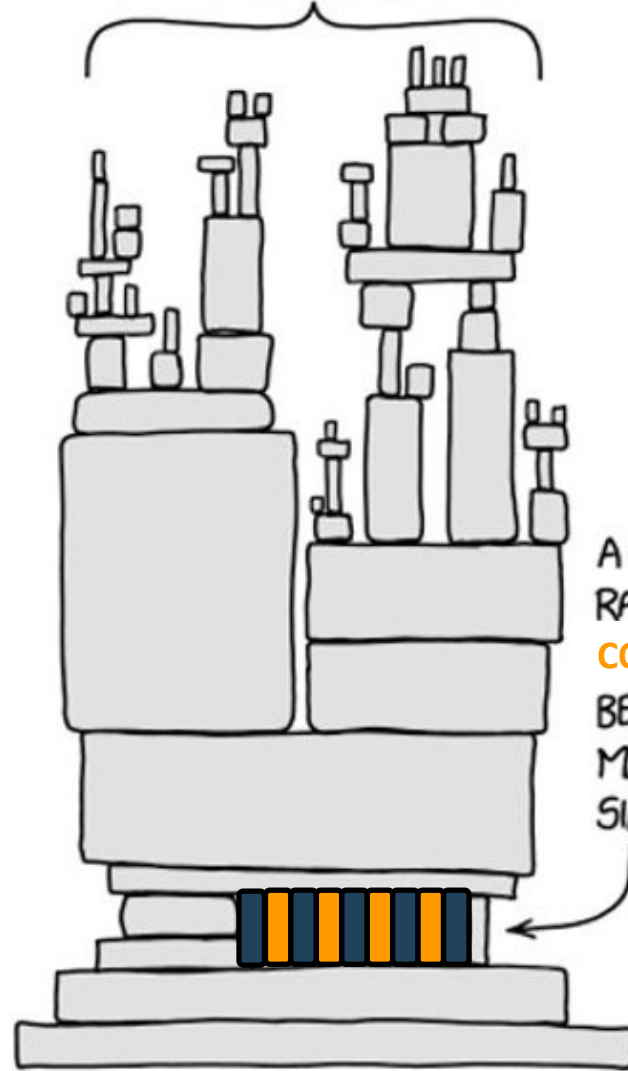
TAB Lead:

Lee Evans

Image source: Paul Nagy

2023 software development achievements

- Health Analytics Data-to-Evidence Suite (HADES)
  - 83 releases & 8 new packages
  - 2 **HADES-wide releases**
  - Evolution of **Strategus** standard
- Release of **BroadSea 3.0**
- Support added for **Snowflake** and **Databricks** database platforms
- Release of **ATLAS v2.13**

Project leads

Martijn Schuemie (HADES)

Lee Evans (BroadSea)

Chris Knoll (ATLAS/WebAPI)

Ajit Londhe (BroadSea)

OHDSI Broadsea 3.0

Traefik Proxy with/without SSL and routing

ATLAS / WebAPI

RStudio HADES

ARES

Broadsea Content Web Page

SOLR Search Index

Vocabulary Import

PHOEBE File Load

ATLAS-DB Demo DB

Image source: Ajit Londhe
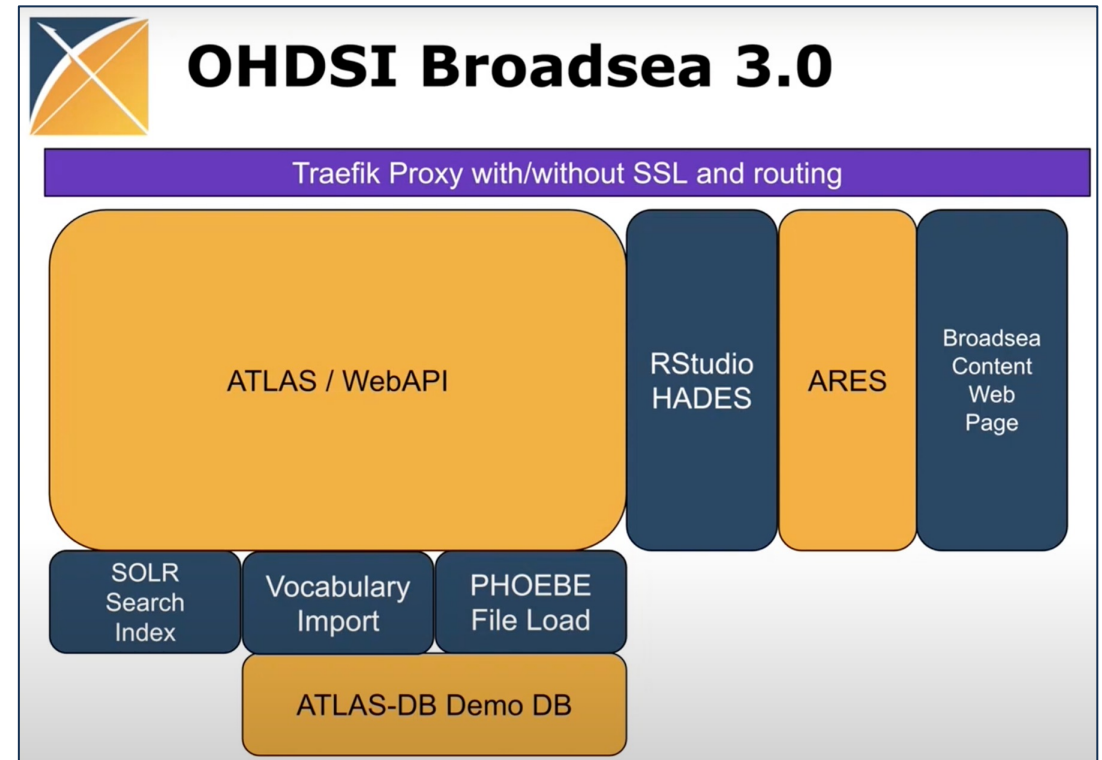
Join the Journey!

Health Analytics Data-to-Evidence Suite (HADES) Hackathon

- Saturday 8:00am-12:00pm and Sunday 1:00pm-5:00pm

- Participants will work on the HADES codebase with support from several HADES maintainers. Participants can work in groups, and we welcome both new and experienced contributors to join

- Target audience: Developers interested in working on the HADES codebase. Some experience in R is recommended
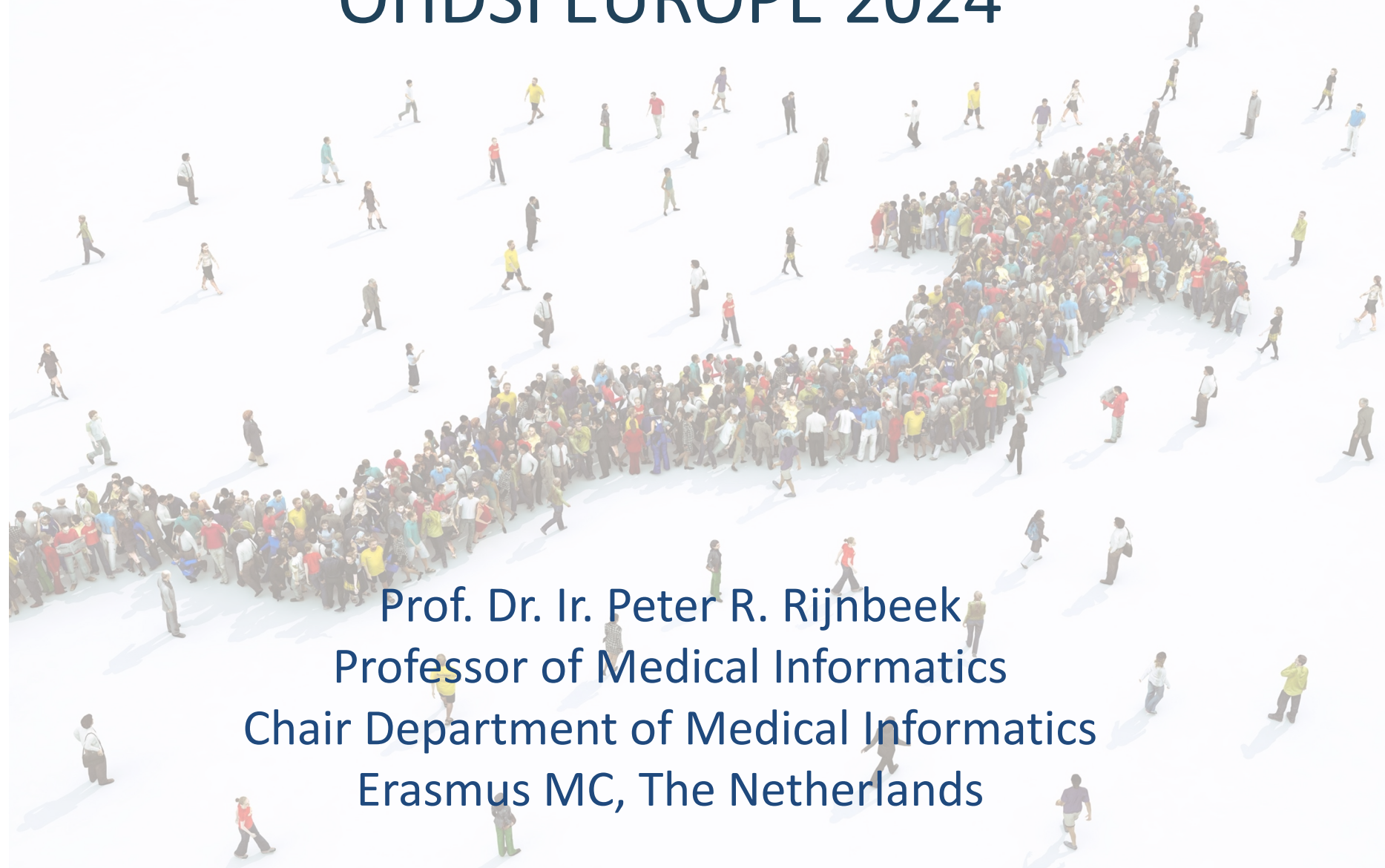
OHDSI Europe 2024

Peter Rijnbeek

Erasmus MC

OHDSI EUROPE 2024

Prof. Dr. Ir. Peter R. Rijnbeek
Professor of Medical Informatics
Chair Department of Medical Informatics
Erasmus MC, The Netherlands

Continued expansion of network in Europe

Geographic spread of data partners. The shade of blue indicates the # of data partners in that country (darker = more)

Multiple other projects and collaborations initiated beyond EHDEN in Europe (see www.ohdsi-europe.org)

Applications (n=563)
Awarded applications (n=187)

# of Data partners
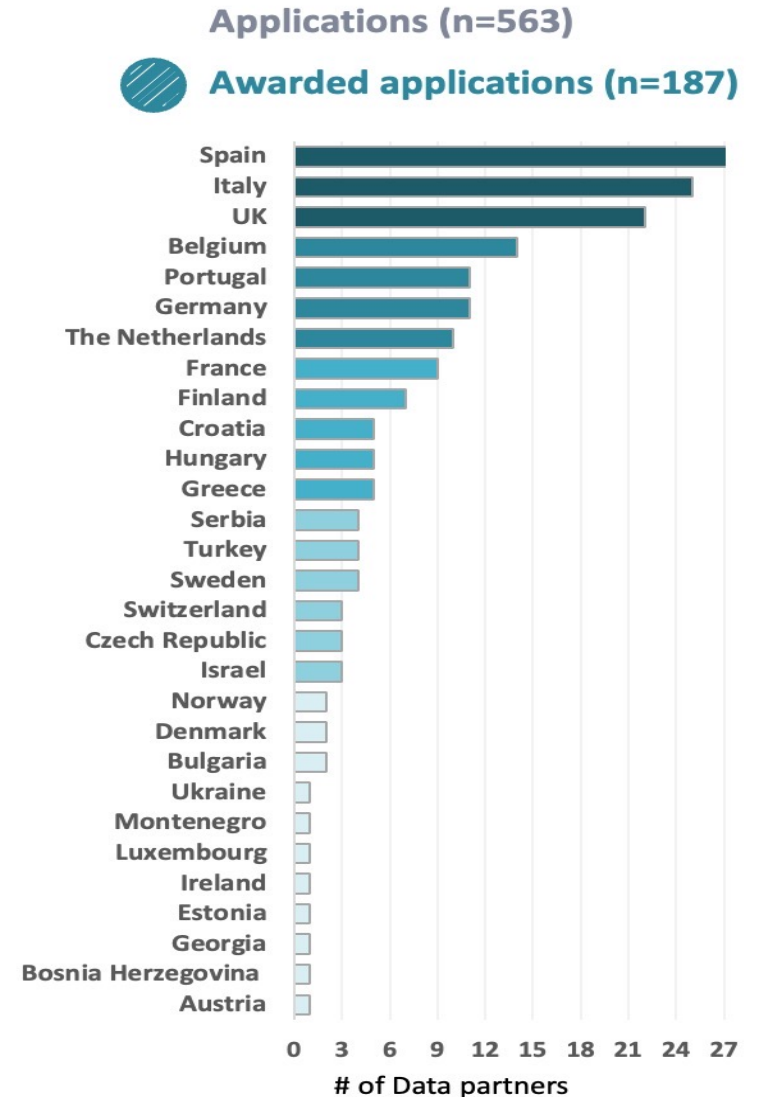
National Nodes Expansion

> 200 organisations are already involved

- Belgium
- Germany
- Greece
- Italy
- Luxemburg
- Netherlands
- Portugal
- Spain
- United Kingdom
- Israel (onboarding)
- More to come in 2024.

EUROPEAN OHDSI SYMPOSIUM

July 3rd 2023 Rotterdam
Tutorials: July 1st and 2nd

EUROPE

"Full Steam Ahead!!"

ROTTERDAM

Organised by:

Erasmus MC
Universitair Medisch Centrum Rotterdam

Health Data Science

See www.ohdsi-europe.org for all presentations and posters
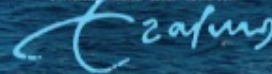
This year's Symposium was a great success!

The numbers

- 3 days
- 350 attendees
- 5 plenary sessions
- 10 rapid fire presentations
- 89 posters
- 7 national nodes
- 5 software demo's
- 2 blues brothers

Thank you for your support!

Erasmus MC   The Hyve   ODYSSEUS DATA SERVICES INC

PROMPTLY   IOMED   BIOMERIS

IQVIA   MTG   LYNXCARE

edence Health   OHDSI   EHDEN

The vibe
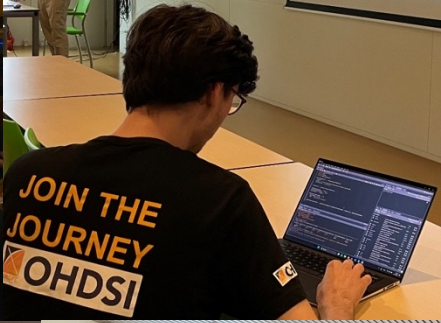
Introduction to OHDSI (Saturday)

≈ 45 participants completely new to the community joined

- What is OHDSI?
- What can currently be done?
- What does it take?
- Community & learning more

Showcase

- Observational data standards and management (45)
- Open-source analytics development (5)
- Clinical applications (28)
- Methodological research (11)
- Early investigators mentor meetings
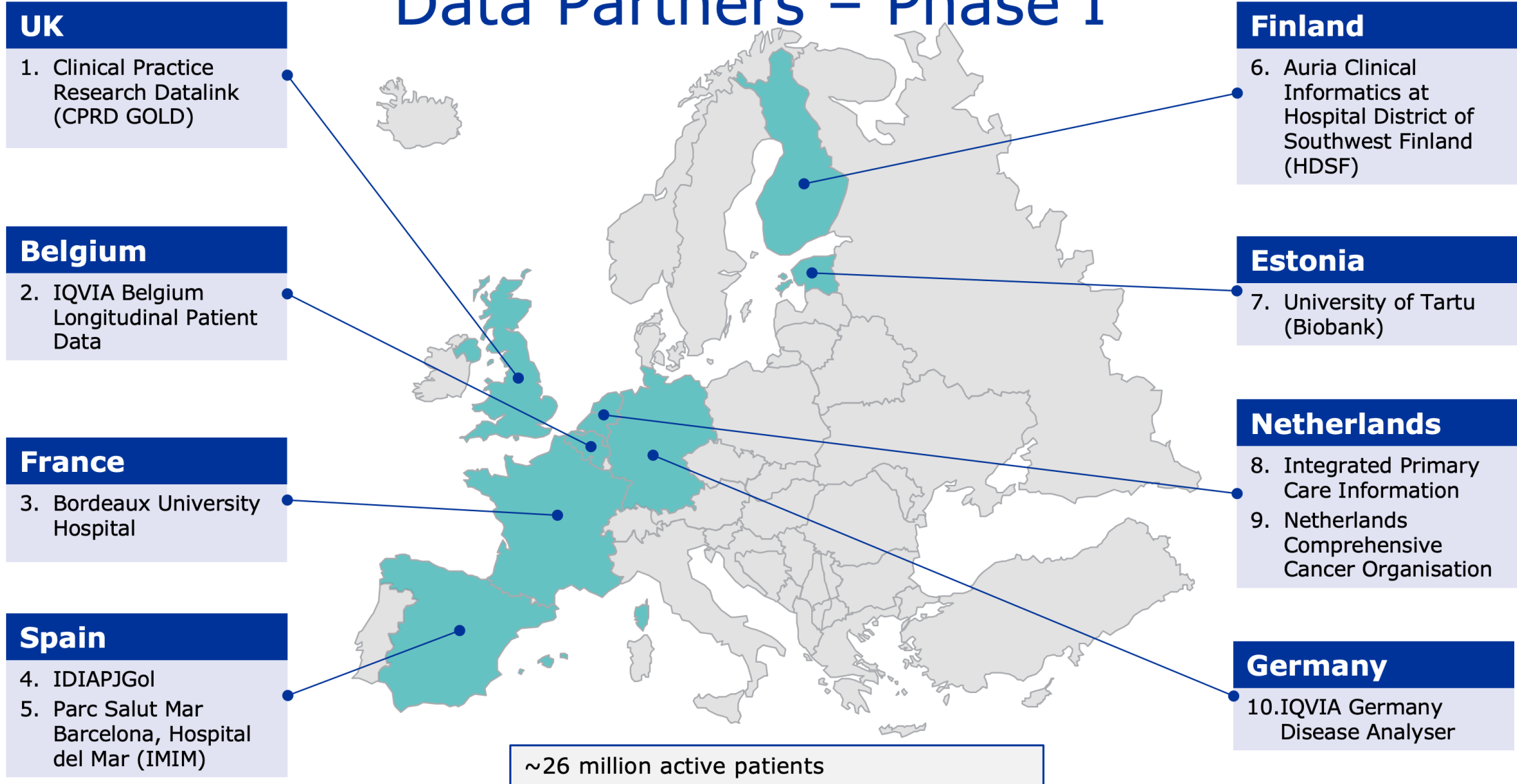
Data Analysis and Real World
Interrogation Network (DARWIN EU®)

Questions and Answers Session

Are you on this picture next year??

Email: info@ohdsi-europe.org

OHDSI APEC Symposium 2024

Singapore Chapter Co-Chairs:

Dr. Mengling 'Mornin' Feng

Senior Assistant Director, National University Health System

Assistant Professor, National University of Singapore

ephfm@nus.edu.sg

APAC Symposium 2024

6-9 Dec 2024

APAC Symposium 2024
Day 2-3: Data-thon

APAC Symposium 2024
Day 4: Official Symposium

APAC Symposium 2024
Preparing for Singapore

APAC Symposium 2024

6-9 Dec 2024

OHDSI 2023 Symposium Agenda today

Time	Topic
7:30 - 8:30 am East Brunswick Room + Grand Ballroom Foyer	**Symposium Registration, Lite Breakfast Buffet, All-Day Exhibits**
8:30 - 9:30 am Grand Ballroom	**State of the Community** **OHDSI: Where have we been? Where are we going?** George Hripcsak, Columbia Univ. **Community Highlights:** • OMOP CDM users and the OHDSI data network Clair Blacketer, Johnson & Johnson • OHDSI standardized vocabularies Alexander Davydov, Odysseus Data Services • OHDSI's open-source community Katy Sadowski, Boehringer Ingelheim • OHDSI Europe 2024 Peter Rijnbeek, Erasmus MC • OHDSI Asia-Pacific 2024 Mengling Feng, National Univ. of Singapore
9:30 - 10:30 am Grand Ballroom	**OHDSI Community Networking** **Moderators:** • Faaizah Arshad, Univ. of California-Los Angeles • Cynthia Sung, Duke-NUS Medical School
10:30 am - 12:00 pm Grand Ballroom	**Plenary: Improving the reliability and scale of case validation** **Presenters:** • Patrick Ryan, Johnson & Johnson, Columbia Univ. • Anna Ostropolets, Odysseus Data Services • Martijn Schuemie, Johnson & Johnson, Univ. of California-Los Angeles
12:00 pm - 1:00 pm Grand Ballroom Foyer	**Buffet Lunch**

OHDSI 2023 Symposium Agenda today

Time	Topic
1:00 pm - 2:00 pm Grand Ballroom	**Panel: Lessons learned from OHDSI network studies** **Presenters:** • Insights from LEGEND-T2DM Marc Suchard, Univ. of California-Los Angeles • Intravitreal anti-VEGF and risk of kidney failure: A Sisyphus Challenge Study Cindy X Cai, Johns Hopkins Univ. • Fluoroquinolones and the risk of aortic aneurysm: A Sisyphus Challenge study Seng Chan You, Yonsei Univ. • Lessons learned applying the Strategus framework across the OHDSI network Anthony Sena, Johnson & Johnson **Moderator:** Sarah Seager, IQVIA
2:00 pm - 2:45 pm Grand Ballroom	**Collaborator Showcase, Lightning Talk Session #1:** **Data Standards and Methods Research** • Mapping of Critical Care EHR Flowsheet data to the OMOP CDM via SSSOM Polina Talapova, SciForce • Paving the way to estimate daily dose in OMOP CDM for Drug Utilisation Studies in DARWIN EU® Theresa Burkard, Univ. of Oxford • Generating Synthetic Electronic Health Records in OMOP using GPT Chao Pang, Columbia Univ. • Comparing concepts extracted from clinical Dutch text to conditions in the structured data Tom Seinen, Erasmus MC • Finding a constrained number of predictor phenotypes for multiple outcome prediction Jenna Reps, Johnson & Johnson **Moderator:** Davera Gabriel, Johns Hopkins University
2:45 - 3:30 pm Grand Ballroom	**Collaborator Showcase, Poster / Demo Session #1** **Poster walk leads:** • Data standards: Mui Van Zandt, IQVIA • Methods research: Christophe Lambert, Univ. of New Mexico • Open-source development: Paul Nagy, Johns Hopkins Univ. • Clinical applications: Kristin Kostka, Northeastern University

Time	Topic
3:30 pm - 4:15 pm Grand Ballroom	**Collaborator Showcase, Lightning Talk Session #2:** **Methods Research and Clinical Applications** • Synthesizing Evidence for Rare Events: a Novel Zero-Inflated Bivariate Model to Integrate Studies with Double-Zero Outcomes Lu Li, Univ. of Pennsylvania • Active Safety Surveillance Using Real-world Evidence (ASSURE): An application of the Strategus package Kevin Haynes, Johnson & Johnson • Patient's outcomes after endoscopic retrograde cholangiopancreatography (ERCP) using reprocessed duodenoscope accessories: a descriptive study using real-world data Jessica Maruyama, Precision Data • Does COVID-19 Increase Racial/Ethnic Differences in Prevalence of Post-acute Sequelae of SARS-CoV-2 infection (PASC) in Children and Adolescents? An EHR-Based Cohort from the RECOVER Program Bingyu Zhang, Univ. of Pennsylvania • Eye Care and Vision Research Workgroup: First Year Update Michelle Hribar, National Institutes of Health – National Eye Institute **Moderator:** Atif Adam, IQVIA
4:15 - 5:00 pm Grand Ballroom	**Collaborator Showcase, Poster / Demo Session #2** **Poster walk leads:** • Data standards: Melanie Philofsky, Odysseus Data Services • Methods research: Andrew Williams, Tufts Univ. • Open-source development: Nsikak Akpakpan, Accenture • Clinical applications: Hanieh Razzaghi, Childrens Hospital of Pennsylvania
5:00 pm - 6:00 pm Grand Ballroom	**Closing session: Scaling community, scaling collaboration** • Titan Awards • Group Photo **Presenter** Patrick Ryan, Johnson & Johnson, Columbia Univ.
6:00 pm - 7:00 pm East Brunswick Room Grand Ballroom Foyer	**Networking Reception and Exhibits**
7:00 pm - 8:00 pm Grand Ballroom	**OHDSI Got Talent!**

Congrats to our 2023 Titan Award Nominees!

Please stand!

Alexander Davydov · Aniek Markus · Anna Ostropolets · Anthony Sena · Asieh Golozar · Asiyah Lin · Atif Adam · Azza Shoaibi · Can Yin · Carlos Diaz · Center for Surgical Science team · Christie Quarles · Chungsoo Kim · Cindy Cai · Clair Blacketer · Clark Evans · Craig Sachson · Cynthia Sung · Dana Zakrzewski · Danielle Boyce · Davera Gabriel · Debo Wei · Eleanor Davies · Elisse Katzman · Erica Voss · Evan Minty · Frank DeFalco · Geert Byttebier · Georgina Kennedy · Gowtham Rao · Grahame Grieve · Gregory Klebanov · Gyeol Song · Henrik John · Hugo Vernooij · IQVIA OMOP Productized Analytics · Ismail Gogenur · Jack Brewster · James Brash · James Gilbert · Jared Houghtaling · Jasmine Gratton · Jenna Reps · Jiawei Qian · Jiayi (Jessie) Tong · Jing Li · Joel Swerdel · John Gresh · Katherine Duszynski · Katy Sadowski · Kyle Zollo-Venecek · Kyrylo Simonov · LAISDAR Study Team · Lee Evans · Lydia Liu · Manlik Kwong · Marc Suchard · Marc Twagirumukiza · Marcel de Wilde · Masha Khitrun · Marti Catala · Martijn Schuemie · Martin Lavallee · Marty Alvarez · Meghan Pettine · Mengyuan Shang · Michael Matheny · Michelle Hribar · Milou Brand · Montse Camprubi · Nathan Buesgens · Nathan Hall · Nicole Pratt · Nigel Hughes · Nikolai Grewe · OHDSI Vocabulary Team · Oleg Zhuk · Paul Dougall · Paul Nagy · Polina Talapova · Raivo Kolde · Renske Los · Sally Baxter · Sarah Seager · Stephen Town · Tal El-Hay · Thamir Alshammary · Thomas Falconer · Timur Vakhitov · Varvara Savitskaya · Vipina Keloth · Xiaoyu Lin

Winners will be announced during the #OHDSI2023 Closing Talk!

Agenda · Saturday, Oct. 21

Time	Topic
7:00 - 8:00 am Grand Ballroom Foyer	Lite Breakfast Buffet, All-Day Exhibits
8:00 am - 12:00 pm Various rooms	Introduction to OHDSI Tutorial Common Data Model/Network Data Quality WG Meeting Health Analytics Data-to-Evidence Suite (HADES) Hackathon Health EquityWG Meeting Medical Imaging WG Meeting Natural Language Processing WG Meeting OHDSI Industry WG Kickoff Meeting Oncology WG Meeting Phenotype Development & Evaluation WG Meeting Pregnancy and Reproductive Health Group (PRHeG) WG Meeting
12:00 - 1:00 pm Ballroom Foyer/ Ballroom	Lunch Buffet, Collaborator Showcase, All-Day Exhibits
1:00 pm - 5:00 pm Grand Ballroom	HowOften Large-Scale Characterization Workshop
5:00 pm	Free Time

Agenda · Sunday, Oct. 22

Time	Topic
7:00 - 8:00 am **Grand Ballroom Foyer**	**Lite Breakfast Buffet, All-Day Exhibits**
8:00 am - 12:00 pm **Grand Ballroom/** **Room TBA**	**HowOften Large-Scale Characterization Workshop** **HL7 FHIR-OMOP Connectathon**
12:00 - 1:00 pm **Ballroom Foyer/** **Ballroom**	**Lunch Buffet, Collaborator Showcase, All-Day Exhibits**
1:00 pm - 5:00 pm **Various Rooms**	**Africa Chapter Workshop** **Eye Care & Vision Research WG Meeting** **Health Analytics Data-to-Evidence Suite (HADES) Hackathon** **Healthcare Systems Interest Group (HSIG) WG Meeting** **HL7 FHIR-OMOP Connectathon** **ISPE RWE for Pharmacovigilance** **Medical Devices WG Meeting** **Psychiatry WG Meeting** **Vocabulary WG Meeting**
5:00 pm	**Symposium Closing**